Ponts JACQUES CARTIER + CHAMPLAIN Bridges

Canada

Parsons

Tetra Tech

Amec Foster Wheeler

Deconstruction of the Existing Champlain Bridge

Targeted Environmental Analysis

Final Report

Volume 1, sections 1 to 3

Description of the Project and the Environment

November 2019

Contract No 62555

Ponts
JACQUES CARTIER +
CHAMPLAIN
Bridges
Canada

DECONSTRUCTION OF EXISTING CHAMPLAIN BRIDGE

(2017-2022)

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Executive Summary

This document is the Targeted Environmental Analysis (TEA) for the deconstruction of the Existing Champlain Bridge. It consists of three parts: Volume 1 consists of a description of the project and environment, Volume 2 an assessment of the impacts and the mitigation measures, and Volume 3 the appendices referred to by Volumes 1 and 2. This study is part of the same initiative as the 2013 Environmental Assessment (EA) carried out by Transport Canada, which pertained, among other aspects, to both the construction of the New Bridge for the St. Lawrence (NBSL) and the deconstruction of the Existing Bridge. This TEA is being done to update the 2013 EA. Since the project will be carried out on a design-build basis, the project description presented below is only tentative and presents the options available to the contractor for deconstruction. The impacts are assessed based on these various options and mitigation measures are proposed to limit the effects of the works. The contract that will bind the contractor will include these mitigation measures in the form of performance objectives to be met during its design and the actual works.

This report was prepared so that the responsible authorities (Fisheries and Oceans Canada (DFO) and Transport Canada (TC)) can perform their assessment and confirm that the EA that was completed in 2013 on the overall project, including the deconstruction of the Existing Champlain Bridge, is still applicable and valid given the mitigation measures that will be proposed or modified.

Given the conclusions of the experts' reports on the level of deterioration of the Existing Champlain Bridge, along with an estimate of the increasingly higher maintenance costs to maintain the required safety levels, without any structural problems being resolved, the federal government concluded that the Champlain Bridge had reached the end of its useful life and would have to be replaced. In October 2011, the Government therefore decided to build a new bridge about 10 m downstream of the Existing Bridge, which has to be demolished once the New Bridge is opened. At that time, construction of the New Bridge was slated to begin in 2017 and end in 2021. In fall 2013, a major failure in the Champlain Bridge resulted in its partial closure and urgent major repairs to ensure the bridge's structural integrity and the safety of users. New analyses also revealed that the Existing Champlain Bridge was deteriorating more quickly than anticipated, and that despite the severe restrictions that were in place, the process of replacing the bridge would have to be speeded up. Given the strategic importance of the Champlain Bridge for the Montreal area, Infrastructure Canada (which had become the developer following an administrative change within the federal government) decided to move up the project schedule with construction starting in 2015 and delivery in 2018, which was three years earlier than planned. To simplify the procurement process for a fast-tracked project, the deconstruction of the existing Champlain Bridge was therefore withdrawn from the call for tenders. The Signature on the Saint Lawrence (SSL) consortium was awarded the contract to build, maintain and manage the New Bridge. Work was started in 2015 and should be completed in 2019.

In 2018, the federal government officially mandated the Jacques Cartier and Champlain Bridges Incorporated (JCCBI), a federal crown corporation, as the developer for the deconstruction of the Existing Bridge.

From a legislation enforcement standpoint, the Canadian Environmental Assessment Agency (the Agency) confirmed in August 2018 that the 2013 EA, which included the deconstruction of the Existing Champlain Bridge, would be adequate to begin deconstruction of the Existing Bridge. Note that the EA for the New Champlain Bridge project was started under the former Canadian Environmental Assessment Act (CEAA). Under the transitional provisions of the Canadian Environmental Assessment Act (2012), and confirmed by ministerial order, the New Champlain Bridge construction project and the deconstruction of the Existing Champlain Bridge were continued under the prior Canadian Environmental Assessment Act. In 2018, the Agency also recommended that steps be taken with the responsible authorities to obtain confirmation that the EA completed in 2013 was still relevant and valid. JCCBI undertook the process in August 2018 and the federal authorities involved (TC and DFO) confirmed that this was the case.

In the present case, despite the fact that different methods could be used for deconstruction, the mitigation measures and environmental objectives to be met and presented in the 2013 Environmental Assessment are valid and applicable for these different methods.

Given the above, and in continuation with the 2015 TEA conducted by Infrastructure Canada that involved updating the area of encroachment in fish habitat, a TEA for the deconstruction project was started by JCCBI and is the subject of this report. This TEA aims at assessing the effects of the other possible deconstruction methods and determining whether the mitigation measures and the objectives drawn up in relation to the 2013 EA are still appropriate, improving them or suggesting new ones, if required, based on 2019 best practices and the lessons learned in the construction of the New Bridge. The project components remain the same (deconstruction), and therefore, only coordination with DFO and TC to assess the impact on fish habitat and navigation will be required given that the two authorities must respectively issue an authorization and approval in relation to the project. ECCC will be consulted for the impacts on wetlands and migratory birds, but does not first have to issue any permits, approvals or authorizations. However, JCCBI broadened the environmental components that were reviewed to make sure to add, where applicable, enhanced and updated mitigation measures for all the elements likely to be affected.

There are several possible methods for the deconstruction of the various parts of the Existing Bridge. The 2013 Environmental Assessment stated that the concrete spans and piers would be sawn and the steel spans dismantled. All of these elements would be recovered using barges, transported to land, cut into smaller pieces that can be transported by truck, and taken to landfill, recovery or reuse sites.

In 2017, the Consortium of Parsons, Tetra Tech, Amec Foster Wheeler (PTA) studied the various possible deconstruction methods based on the different types of bridge structures and access options (on land, jetty, by water using barges). These methods were reviewed in this TEA. Unlaunching could be used for the concrete deck, but conventional options (hydraulic and pneumatic hammers, shear-type concrete breaker (jaws)) or a crane are also possible. For the steel deck, the cantilever or dehoisting methods are an option, depending on the deck section, but the reverse construction method could also be used. For the pier caps, pier shafts and footings, conventional methods using cofferdams and sawing are possible options, depending on the bridge sections involved. JCCBI prohibits the use of controlled explosion.

Four mobilization sites could be used for deconstruction: one in Nuns' Island, one on the Seaway dike, and two on the Brossard side. A fifth site, located in Brossard, was added to temporarily store part of the materials from the SSL jetties that can be reused for the construction of the deconstruction jetties.

Lastly, the size of the temporary jetties on Nuns' Island, the Seaway Dike and in Brossard, where the water is not deep enough for the barges, was established. These jetties constitute the maximum encroachment in the aquatic environment. Other options such as access via a temporary bridge on piles could also be considered.

Regarding the description of the physical environment, contaminated soil, sediment and groundwater are found in the work area. The surface water meets provincial and federal criteria for maintaining aquatic life. Some contaminants may be present on the structure of the Existing Bridge, and a detailed characterization was done to confirm and locate the contaminated areas and propose adequate management methods. Air quality remains an issue in relation to the project, due to the anticipated particulate matter (PM), lead and silica emissions from the operation of machinery and work in general during deconstruction.

With respect to the biological environment, there are several special-status wildlife and plant species, including the Brown Snake and Peregrine Falcon. The Cliff Swallow colony nesting on the Existing Bridge is an issue that will be managed through compensatory measures aimed at favouring their relocation along with a monitoring program. There is also a migratory bird sanctuary that begins under the northern half of the Existing Champlain Bridge, just west of pier 1E, in the Lesser La Prairie Basin, Couvée Islands, which must be protected during the works. Lastly, fish habitats qualified as sensitive are found in the study area and temporary encroachments associated with the presence of jetties will have to be compensated by one or more mitigation projects.

Regarding the description of the human environment, the Aboriginal community of Kahnawake is located a dozen kilometres southwest of the Existing Bridge. There is no commercial fishing in the study area; however, there is recreational fishing all over the waterway. The section of the St. Lawrence River in the study area is not suitable for commercial shipping, with the exception of the Seaway. There is recreational boating in the St. Lawrence. There are several bicycle paths in the study area. There are no known archaeological sites in the deconstruction work area. Several areas sensitive to increases in noise levels are found near the work zones, and this aspect is also an issue for the project and a concern to riverside residents.

The elements described above clearly depict the context in which the deconstruction project is carried out. Volume 2 of the TEA presents the project's environmental effects and will also cover the mitigation measures that will be implemented to eliminate or reduce the anticipated effects.

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List of Acronyms

ABBREVIATIONS	FULL NAME
AADT	Annual average daily traffic
AARQ	Atlas of Amphibians and Reptiles of Québec
AB	As built
AMQ	Association maritime du Québec
AONQ	Québec Breeding Bird Atlas (Atlas des oiseaux nicheurs du Québec)
ARCDW	Act Respecting the Conservation and Development of Wildlife
ARTVS	Act Respecting Threatened or Vulnerable Species
BAnQ	Bibliothèque et Archives nationales du Québec
BCA	Breeding conservation area
CABIN	Canadian Aquatic Biomonitoring Network
CBC	Christmas Bird Count
CCDG	Cahier des charges et devis généraux of the MTQ (in French only)
CCG	Canadian Coast Guard
CCME	Canadian Council of Ministers of the Environment
CDPNQ	Centre de données sur le patrimoine naturel du Québec
CEAA	Canadian Environmental Assessment Agency

CIS	Canadian Ice Service
cm	Centimetre
CNESST	Commission des normes, de l'équité, de la santé et de la sécurité du travail
CNWA	Canadian Navigable Waters Act
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
DFO	Department of Fisheries and Oceans Canada
DNA	Deoxyribonucleic acid
DU	Ducks Unlimited
EA	Environmental assessment
ECCC	Environment and Climate Change Canada
ÉPOQ	Étude des populations d'oiseaux du Québec (study of Quebec bird populations)
EPT	Ephemeroptera-Plecoptera-Trichoptera
EQA	Environment Quality Act
FEL	Frequent effect level
GCQ	Groupe Chiroptères du Québec
GHG	Greenhouse gases
GPS	Global positioning system
ha	hectare
HBI	Hilsenhoff Biotic Index
HWM	High-water mark
IAS	Invasive alien species
IBA	Important Bird Areas Canada
IDS	L'Île-des-Soeurs (Nuns' Island)
INAC	Indigenous and Northern Affairs Canada
INFC	Infrastructure Canada
JCCBI	The Jacques Cartier and Champlain Bridges Incorporated
kg	Kilogram
km	Kilometre
km^2	Square kilometre
m	Metre
m^2	Square metre
m^3/s	Cubic metres per second
MBCA	Migratory Birds Convention Act, 1994

MBS	Migratory bird sanctuary
MCK	Mohawk Council of Kahnawake
MDDEFP	Ministère du Développement durable, de l'Environnement, des Forêts et des Parcs
MDDEP	Ministère du Développement durable, de l'Environnement et des Parcs
MELCC	Ministère de l'Environnement et de la Lutte contre les changements climatiques
MFFP	Ministère de la Faune, des Forêts et des Parcs
mt	Metric tonne
MTQ	Ministère des Transports du Québec (Quebec Ministry of Transport)
NBSL	New Bridge over the Saint Lawrence
NCC	Nature Conservancy of Canada
No.	Number
NOL	No effect level
OEL	Occasional effect level
PAH	Polycyclic aromatic hydrocarbons
PCB	Polychlorinated biphenyls
PEL	Probable effect level
PTA	Consortium of Parsons, Tetra Tech and Amec Foster Wheeler
RM	Residual materials
SARA	Species at Risk Act
SEG	Permit for scientific, educational and wildlife management purposes
SLSMC	St. Lawrence Seaway Management Corporation
sq. ft.	Square foot
SS	Suspended matter
SSL	Signature on the Saint Lawrence
TC	Transport Canada
TEA	Targeted Environmental Analysis
TOC	Total organic carbon
TP	Total phosphorus
TTC	Tetra Tech/Cima
µm	Micrometre
WGA	Waterfowl gathering area
ZIP	Zone d'intervention prioritaire (Priority intervention zone)

Glossary

Decking	Flat horizontal surface enabling vehicles to drive over; can be made of various materials such as steel, wood or concrete
Driven piles	Steel or concrete tube driven into the ground with a pile driver to reinforce a foundation when soil is of lower quality
Cofferdam	Temporary dam put in place to allow work below water level
Gantry crane	Steel structure on rails for lifting and moving loads.
Corbelling	Bridge construction technique of adding or removing bridge sections sequentially
Asphalt surface	Surface course, bitumen
Paired truss girders	Steel truss beams assembled in triangular shape
Cantilever	Bridge whose main beams extend in cantilever and support a reduced span beam in return
Temporary pile group	Row of steel piles or supports driven into the ground, forming a rigid barrier so that one side of the barrier can be excavated
Leveling	Leveling of a land feature. With regard to piers, it refers to the level at which they are cut from their foundation
Floe	Any relatively flat fragment of ice 20 m or more across
Left bank and right bank	The lateralization of the banks of a body of water (river, stream, torrent, creek) by an observer looking in the direction of flow, i.e. from upstream todownstream. The left bank is then located to the observer's left, and the right bank to his right. In this report, South Shore, right bank and Brossard side are equivalent and identify the same geographic point, as do the notions of North Shore, left bank and Nuns' Island side.

1 INTRODUCTION

This document is the TEA for the deconstruction of the Existing Champlain Bridge. It consists of three parts: Volume 1 consists of a description of the project and environment, Volume 2 an assessment of the impacts and the mitigation measures, and Volume 3 the appendices referred to by Volumes 1 and 2. This study is part of the same initiative as the 2013 EA carried out by TC, which pertained, among other aspects, to both the construction of the New Bridge and the deconstruction of the Existing Bridge. It is an update of the 2013 EA, but only covers the deconstruction of the Existing Bridge. The 2013 EA information was updated in order to have a recent overview of the environment and the specific mitigation measures suited to deconstruction. Some parts of the 2013 study were included verbatim to make the document easier to read and understand.

Since the project will be carried out on a design-build basis, the project description presented below is only tentative and presents the work methods that may be used by the contractor for deconstruction. The impacts are assessed based on these various possible methods and mitigation measures are proposed to eliminate or limit the impact of the works. The contract that will bind the contractor will include these mitigation measures in the form of performance objectives to be met during its design prior to the works and the actual works.

1.1 BACKGROUND

In operation since 1962, the Existing Champlain Bridge is one of the busiest bridges in Canada, with 40 to 60 million crossings per year and $20 billion in transported freight each year. It acts as a point of transit between the Island of Montreal, the South Shore, the eastern United States, and western North America. Furthermore, it is a major link for public transit and freight transport by truck, as well as a strategic link in the Port of Montreal transportation network, which has an area of influence extending as far as the American Midwest (Transport Canada, 2012).

Given the conclusions of the experts' reports on the level of deterioration of the Existing Champlain Bridge, along with an estimate of the increasingly higher maintenance costs to maintain the required safety levels, without any structural problems being resolved, the federal government concluded that the Champlain Bridge had reached the end of its useful life and would have to be replaced. In October 2011, the Government therefore decided to build a New Bridge about 10 m downstream of the Existing Bridge, which has to be demolished once the New Bridge is opened. At that time, construction of the New Bridge was slated to begin in 2017 and end in 2021.

The EA for the New Champlain Bridge project was carried out under the prior Canadian Environmental Assessment Act in accordance with the transitional provisions of the Canadian Environmental Assessment Act (2012) and as confirmed at the time by a ministerial order. TC acted as project proponent and responsible authority for the preliminary assessment conducted under Section 18 of the prior Act, while DFO and Environment and Climate Change Canada (ECCC) were the other responsible authorities for the 2013 EA.

The 2013 EA involved both the construction of the New Bridge and the deconstruction of the Existing Bridge, among other aspects. For the deconstruction of the Existing Champlain Bridge, the description of the method was based on sawing the concrete spans and piers using diamond-encrusted wire cables and dismantling the entire steel spans, followed by dismantling into simpler elements. The largest pieces should then be transported by barge to the Seaway jetty, where the blocks would be reduced and then taken by truck to the South Shore. The 2013 EA also mentioned that the footings of certain piers could be kept in place to not disturb the river bed and potentially enable the creation of fish habitats, but that this aspect should be reviewed before a final decision is made. The above work should take an estimated three years to complete.

One of the particular features of the 2013 EA was that it used an objective-based approach. This approach was used since it is well suited to projects where some details have not yet been defined or will be known at a later time. Several mitigation measures and objectives were presented in the 2013 EA for the deconstruction of the Existing Bridge, reflecting the trends and good practices at the time.

After taking into account the 2013 EA and the public's observations, the responsible authorities under subsection 20(1) of the Canadian Environmental Assessment Act considered that the project (including the deconstruction of the Existing Bridge) was not likely to have any major adverse environmental effects, given the application of the mitigation measures stipulated in the 2013 EA. The responsible authorities therefore signed the Screening Report in August and October 2013.

In fall 2013, a major failure in the Champlain Bridge resulted in its partial closure and urgent major repairs to ensure the bridge's structural integrity and the safety of users. New analyses also revealed that the Champlain Bridge was deteriorating more quickly than anticipated, and that despite the severe restrictions that were in place for heavy vehicles to minimize wear on the structure and the use of a hundred beams as reinforcement, the bridge replacement process had to be stepped up.

Given the strategic importance of the Champlain Bridge for the Montreal area, Infrastructure Canada (which had become the developer following an administrative change within the federal government) decided to move up the project schedule with construction starting in 2015 and delivery in 2018, which was three years earlier than planned. To simplify the procurement process for a fast-tracked project, the deconstruction was not part of the call for tenders. Therefore, although the deconstruction is still part of the New Bridge for the St. Lawrence (NBSL) project, this part currently involves a separate call for tenders by JCCBI since early 2019.

The engineering firm ARUP, contracted by Infrastructure Canada (INFC), began the development of the reference design (2014) for the construction of the New Champlain Bridge (therefore, without the deconstruction). The concept enabled plans to be designed at a level of +/-15% and involved better detailing of the technical elements of the construction of the New Bridge and the construction methods. Although not final, the concept enabled the call for tenders to be launched for the construction in a public-private partnership. The final concept also showed that serious harm to fish and fish habitat (temporary encroachment on fish habitat) was much greater than what had been estimated in the 2013 EA.

In 2015, a TEA was therefore done by Infrastructure Canada to update the analysis of the environmental effects of increasing the temporary-encroachment areas in fish habitat for the construction of the New Champlain Bridge (IC, 2015). This analysis did not include the encroachments associated with deconstruction since this component had been withdrawn from the contract with the SSL consortium in charge of the NBSL project.

The SSL consortium was awarded the contract to build, maintain and manage the new bridge. Work began in 2015 and the bridge was opened to traffic in late June 2019. Work should be completed in 2019.

1.2 PROJECT PROPONENT AND ROLE

The Jacques Cartier and Champlain Bridges Incorporated (JCCBI) is a federal Crown corporation established in 1978 that is responsible for the Jacques Cartier and Champlain bridges, the Champlain Bridge Ice Control Structure, the Nuns' Island Bypass Bridge, the federal sections of the Bonaventure Expressway and the Honoré Mercier Bridge, as well as the Melocheville Tunnel.

Every day, the Corporation ensures that thousands of users cross the bridges safely by managing, maintaining and repairing these major infrastructures for the Greater Montreal Area. The Corporation also ensures that these critical structures remain safe, fully functional and esthetically pleasing both today and in the future. It conducts construction, rehabilitation and reinforcement projects on the infrastructures under its responsibility and oversees their operation and maintenance.

Following a decision by the Government of Canada, JCCBI is acting as proponent for the deconstruction of the Existing Champlain Bridge. As such, it ensures federal coordination with the other federal government departments and agencies involved by the project.

1.3 PROJECT LOCATION AND STUDY AREAS

The section of the Existing Champlain Bridge slated for deconstruction is located between Nuns' Island and Brossard. The project work area thus covers the various bridge structures to be dismantled as well as the mobilization zones that will be required as work and storage areas (Map 1). These are defined in more detail in section 2.1.2 and are located on Nuns' Island, near the Seaway dike and in Brossard.

The study area for the various environmental components varies depending on the components and the potential direct and indirect effects which the project could generate. This study area is defined in the sections of the environments description and depicted on the maps.

1.4 PROJECT RATIONALE

The Existing Champlain Bridge was built in 1962, almost 60 years ago. It had been designed using pre-stressed concrete beams, and the issues involved with this design were unknown at the time. The design was not suited to Quebec weather conditions and did not provide for the use of de-icing salt in the future.

Originally, the structure did not have a drainage system for channelling runoff away from structural elements. Furthermore, the monolithic structure of the deck and girders prevented damaged elements from being replaced. This led to increased degradation of the edge girders on each side of the bridge and to corrosion in several elements.

Note also that the bridge was not designed for as heavy a volume of traffic (about 60 million vehicles per year).

The problems associated with the initial design of the Existing Champlain Bridge hastened the end of the useful life of several structural elements. The Existing Bridge thus reached the end of its useful life, and in 2011 it was announced that a new bridge would be built to replace it. The New Bridge was opened to traffic in 2019.

The Existing Bridge cannot be maintained for several reasons.

Major maintenance work on the bridge has been required since the 1980s. In 2009, a major 10-year maintenance plan was proposed to extend the bridge's lifespan. Even though this program was continued to maintain the Existing Champlain Bridge after the New Bridge was commissioned, this will not be enough to correct structural problems, which will require increasingly elaborate, complex and costly work over time (estimated at several hundred million dollars). Maintaining the bridge over the long term is not financially viable given its structural deterioration.

The bridge's self weight (dead load) accounts for 80% of the total load, and traffic (live load) accounts for 20%. The bridge will continue to deteriorate over the years and the key structural elements will remain damaged. Given the situation, the Federal Government concluded that the Existing Champlain Bridge had reached the end of its useful life and would have to be replaced, then dismantled.

1.5 LEGAL FRAMEWORK FOR THE ENVIRONMENTAL ASSESSMENT

In 2013, the entire New Bridge project underwent an EA under the CEAA. Although at the time the Canadian Environmental Assessment Act (2012) ("CEAA") came into force on July 6, 2012, the former CEAA had been repealed and the transitional provisions of the CEAA 2012 resulted in the environmental assessments started under the former CEAA to be continued, under certain conditions, under the provisions of the former Act.[1]

Screenings that had been started under the former CEAA could continue under the provisions of the latter Act provided that the projects were specifically designated by regulation or order of the Minister of Environment and Climate Change on the day the CEAA, 2012 came into force. The order designating physical activities, signed by the minister, thus enabled the screening-type environmental assessments for the projects listed in Schedule 1 of the order to continue as if the former CEAA had not been repealed after the CEAA, 2012 came into force. This was the case, for instance, for the New Bridge project, which was designated on July 6, 2012 in the *Ministerial Order Designating Physical Activities* by the Minister of Environment and Climate Change Canada[2].

1 Information on transitional environmental assessments is available at: https://www.canada.ca/en/environmental-assessment-agency/corporate/acts-regulations/legislation-regulations.html

2 https://www.ceaa.gc.ca/9EC7CAD2-882E-4BB7-8A6F-23AB52B93683/Order_Designating_Physical_Activities-eng.pdf

The deconstruction part of the New Bridge project was covered in the 2013 EA (Stantec-Cima+, 2013). The responsible authorities (TC, DFO and ECCC), after having reviewed *Part I of the Environmental Assessment, Full Report* as well as *Part II of the Environmental Assessment, Full Report* and the public's observations, concluded that the entire New Bridge project (also including the deconstruction of the Existing Champlain Bridge) is not likely to create significant adverse environmental effects given the application of the mitigation measures proposed in *Part II of the Environmental Assessment, Full Report*.

The Canadian Environmental Assessment Agency (the "Agency") was thus able to confirm (in August 2018) that the transitional screening carried out for the New Bridge project included the deconstruction of the Existing Champlain Bridge after the New Bridge is built. However, the Agency recommended that confirmation be obtained from the responsible authorities for the New Bridge project, namely, TC, DFO and ECCC, that the EA completed in 2013 is still applicable for the deconstruction of the Existing Champlain Bridge. JCCBI undertook the process in August 2018 and the federal authorities involved (TC and DFO) confirmed that this was the case.

In 2017, JCCBI awarded a contract to the PTA Consortium (PTA, 2017) that involved carrying out a draft-design study to assess the various possible deconstruction methods, in addition to those covered in the 2013 EA. In the present case, despite the fact that different methods could be used for the deconstruction of the Existing Champlain Bridge, the mitigation measures and environmental objectives to be met and presented in the 2013 EA are valid and applicable for these different methods.

Considering the above, and although not specifically provided by the former CEAA or CEAA (2012), JCCBI decided to conduct a TEA to assess the effects of the other possible methods and confirm that the mitigation measures and objectives drawn up in relation to the 2013 EA are still appropriate, improve them or suggest new ones, if required, based on best practices in 2019 and the lessons learned during the construction of the New Bridge. The components of the initial project that include deconstruction and that were assessed in the 2013 EA remain the same, and therefore only coordination with DFO and TC to assess the impact on fish habitat and navigation will be required given that the two authorities must respectively issue an authorization and approval in relation to the project. ECCC will be consulted for the impacts on wetlands and migratory birds, but does not first have to issue any permits, approvals or authorizations. In fact, ECCC is responsible for providing advice on the Policy's application and on certain ecological functions, including those of the habitats of migratory and at-risk species. However, JCCBI broadened the environmental components that were reviewed to make sure to add, where applicable, enhanced and updated mitigation measures for all the elements likely to be affected. This approach, which consists in carrying out a TEA, allows JCCBI to benefit from the lessons learned during the construction of the New Bridge and optimize the environmental protection measures. The TEA approach was already used in 2015 for the New Bridge project when updating the fish habitat encroachment areas. Subsequent to consultations with the responsible authorities (the Agency, DFO, ECCC and TC), JCCBI decided to use the same approach to ensure that the best environmental protection practices were used for the deconstruction project.

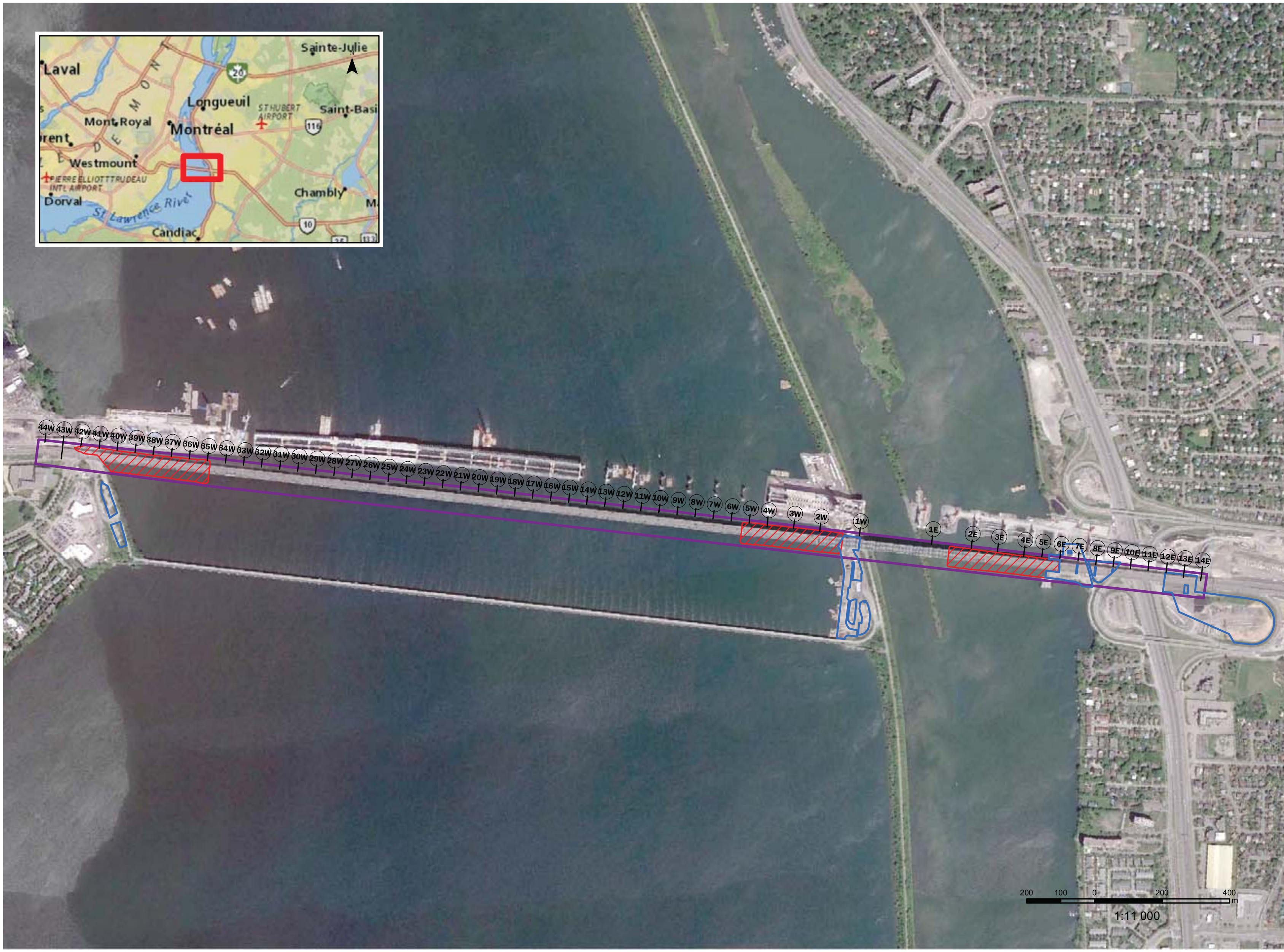
Besides this TEA, the deconstruction project requires certain permits, namely on the part of DFO under the Fisheries Act for serious harm to fish, and TC under the Navigation Protection Act. It is important to mention that Bill C-68, amending the Fisheries Act (FA), and Bill C-69, amending the Navigation Protection Act (now renamed the Canadian Navigable Waters Act (CNWA)) were adopted and came into force in August 2019. The new FA amended the way in which fish habitat losses are referenced, while the CNWA added some watercourses as navigable waters and defined certain notions. These amendments do not invalidate this TEA and the conclusions remain valid.

Given that the deconstruction of the Existing Champlain Bridge will result in the loss of wetlands, in particular on federal land, the Federal Policy on Wetland Conservation applies, and JCCBI is responsible for implementing it. ECCC does not issue any authorizations or permits to authorize the encroachment of wetlands. ECCC is responsible for providing advice on the Policy's application and on certain ecological functions, including those of the habitats of migratory and at-risk species. However, in the event of encroachment of the Migratory Bird Sanctuary (MBS) located right next to the works, ECCC could potentially have to issue a permit under the Migratory Birds Convention Act, 1994 and demand compensation.

1.6 OBJECTIVE-BASED APPROACH OF THE TEA

As the preliminary design study completed in 2017 had shown that various options were available for the deconstruction of the Existing Champlain Bridge, JCCBI decided to use an objective-based approach for the TEA, as TC had done for the New Champlain Bridge. This approach was used since it is well suited to projects where some details have not yet been defined or will be known at a later time.

The mitigation measures are sometimes presented in it as objectives to be met rather than specific parameters to be followed (see Chapter 6, Part 2). The result is ultimately the same, namely, the protection of sensitive environmental components, and furthermore, the environment is thus considered earlier in the project design. Note that these measures and objectives were discussed at workshops with INFC in order to benefit from the lessons learned during the construction of the New Champlain Bridge. They have also been updated based on the best practices in 2019.



Ponts Jacques Cartier + Champlain Bridges
Canada

XX Piers and abutments to be dismantled
Mobilization area
Deconstruction area
Potential jetty

DECONSTRUCTION OF EXISTING CHAMPLAIN BRIDGE (2017-2022)
CONTRACT No. 62555
TARGETED ENVIRONMENTAL ANALYSIS

Location of work area

March 2019
Coordinate system: NAD83 MTM 8
Base map: Here Map

Parsons
Tetra Tech
Amec Foster Wheeler

Map 1

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2 PROJECT DESCRIPTION

2.1 DESCRIPTION OF PROJECT COMPONENTS AND ASSOCIATED WORK

This section presents the scenario for the deconstruction of the Existing Champlain Bridge as considered by the draft design study conducted by PTA (2017). Given the bridge's size, it was divided into sections (see Table 1 and Figure 1). Piers 44W to 41 W (Nuns' Island side), 1W (dike) and 6E to 14E (Brossard) are located over land, while the other piers are located over water.

Table 1 – Existing Champlain Bridge sections

AREA	SPANS (AXES)
5-1	41W to 44W
5-2	36W to 41W
5-3	4W to 36W
6-1	2W to 4W
6-2	0.5W to 2W
6-3	0.5W to 0.5E
6-4	0.5E to 2E
6-5	2E to 4E
7-1	4E to 8E
7-2	6E to 14E

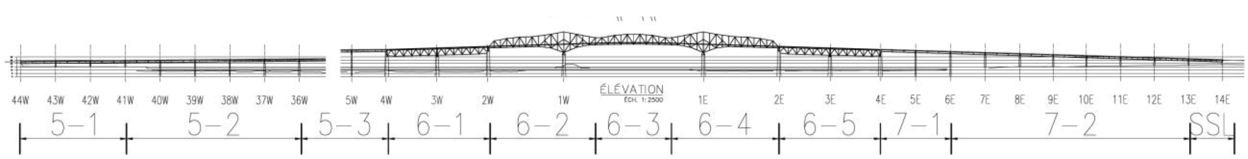


Figure 1 – Champlain Bridge - Areas

2.1.1 ACCESS TO THE VARIOUS WORK AREAS

Access to the Existing Champlain Bridge for deconstruction work will involve a combination of means of access, as the complexity of the structure does not in fact permit only one method to be used. The access methods for the scenario recommended by the preliminary design study are:

- Access by the deck at both ends;
- Access by land to the sections located over dry land;
- Access by barge;
- Access by temporary jetty.

The access method is dependent on several variables, including:

- Chosen deconstruction method;
- Location of the elements to be demolished;
- Characteristics of the ground or the St. Lawrence at the location of the element to be demolished
- Height of the element to be demolished.

2.1.1.1 Access by barge

Barges can be used to create a work area on the water. This surface can be used to support and transport work equipment, support and transport materials or elements, and receive the pieces that will have broken off from the structure.

Modular barges are well-suited to this type of work since they can be connected and set up to form larger surface areas. Depending on the type of barges used and the loads to be supported, barges may be used even at minimum water depths of around one metre.

The draft between axes 41W and 36W is not sufficient for barges to be used. In the past, repair work on these spans had to be done from the deck. The area between axes 1W and 5W also has a low draft that limits the use of barges at certain times of the year. Based on available data, the water level between axes 1E and 6E is adequate for the use of barges only when the Seaway is open, i.e. from April to December. In fact, as the areas are connected, the water level is dependent on that of the Seaway. JCCBI has a dock on the South Shore that provides access.

2.1.1.2 Temporary jetty

A temporary jetty is an access solution for shallow areas. These jetties are generally made of backfill placed in the waterway and removed once the work has been completed. Access by jetty allows the same work methods to be used as for work over land. A jetty will have environmental and hydraulic impacts on the St. Lawrence that must be taken into account. A few sections of the New Champlain Bridge are being built from temporary jetties (Photo 1 and Photo 2). Part of the materials from the jetties are expected to be reused. These will be temporarily stored in mobilization area D, in Brossard, and in a new area E, on the Montreal side (see Appendix 14). These materials will be characterized before being temporarily stored to make sure they are free of contamination and comply with the requested grain size.

Source: photo taken on June 22, 2016.

Photo 1 – View of a jetty for the construction of the New Champlain Bridge from the Seaway dike

Source: newchamplain.ca.

Photo 2 – Jetty on the Brossard side – New Champlain Bridge

Three jetties are considered for the deconstruction of the Existing Champlain Bridge and are presented in Table 2. Note that the proposed jetties are not only similar to those used when the Existing Champlain Bridge was built, but also to those currently used for the construction of the New Bridge.

Table 2 – Dimensions of proposed jetties

JETTY	AXES	LENGTH (M)	WIDTH (M)	WORK AREA (M²)
IDS	41W to 35W	± 322	53	17,066
Dike	1W to 5W	± 289	50	14,450
Brossard	6E to 1.5E	± 322	50	16,100

The jetty on the Nuns' Island side (Figure 2), between axes 41W and 35W (Figure 3 and Figure 4), is required since the water depth does not allow these spans to be accessed by water. This jetty is slightly wider than the other two so that an access ramp can be built. The other two jetties provide continuous access to the spans rather than for a definite period. In fact, on the Brossard side, the water level is lowered when the Seaway is closed, which does not allow barges to be used. In addition, work from a jetty is easier to carry out and offers more flexibility, such as with respect to the weight and size of the allowed equipment and the transportation of materials.

Figure 2 – Drawing – Proposed jetty on the Nuns' Island (IDS) side – photo: April 2016

Figure 3 – Drawing – Proposed jetty in the Seaway dike – photo: April 2016

Figure 4 – Drawing – Proposed jetty in Brossard – photo: April 2016

2.1.1.2.1 Alternatives to jetties

2.1.1.2.1.1 Floating wharf / sectional low-draft barges / pontoons

A floating wharf could be considered for accessing low-draft areas (Photo 3). The floating wharf is made up of modular pontoons (e.g. flexifloat) placed side-by-side and interconnected. The pontoons act as a platform for a provisional deck that will serve as a work area. For shallow areas, some barges can be used by having them sit directly on the riverbed. Depending on the load to be supported, a combination of several pontoons is possible to increase their load-bearing capacity. It is even possible to increase the width of the resulting work area in this way. Naturally, the floating wharf would have to be kept stable, (Photo 4), in particular in relation to the current. Various solutions are possible, such as cables attached to the shore or to moorings on the riverbed. In any case, a system is needed that can operate with the shallow waters and variability in water levels depending on the season.

Photo 3 – Floating wharf

Photo 4 – Floating wharfs/pontoons

2.1.1.2.1.2 Temporary bridge

For the jetty area on the Nuns' Island site, the available data show little or no overburden over the riverbed, thus precluding the use of driven piles. The use of small driven piles embedded into the bedrock could be feasible. Building a jetty with piles under the existing deck is complicated, as there is very little clearance between the Existing Bridge's deck and the top of the projected jetty, and it would then be difficult to make efficient use of the required equipment to install the piles. Therefore, it is projected that the contractor would optimize the surface area of the temporary bridge to reduce it as much as possible, and build most of the bridge slightly outside the existing deck to make it easier to install. Otherwise, a temporary bridge could probably be built by placing steel columns or prefabricated concrete blocks over a moulded-concrete support cushion directly over the rock outcrop. However, rock anchors would likely be needed to stabilize the bridge, and the surface area subject to environmental compensation would be greater than for the piers. Note, however, that the temporary bridge does not allow the submerged part of the piers inside a confined work area to be demolished, and that a cofferdam or other containment system would be needed to demolish the lower part of the pier caps and footings.

2.1.1.2.1.3 Overhead gantry

Use of an overhead gantry is also possible. This system was namely used to build the approach spans for the Highway 25 Bridge. As shown on Photo 5 and Photo 6, it was made up of two gantries with a high lifting capacity and operating on a temporary rail installed under the piers. This type of system could allow girders and pier elements to be handled as part of the deconstruction of the Existing Champlain Bridge. In comparison, the Highway 25 Bridge is slightly wider than the Champlain Bridge, but for its deconstruction, the loads to be handled are much greater. It would be possible to drill caisson piles on either side of the existing deck to install a temporary structure that supports a rail above the St. Lawrence's water level. The gantries would then be chosen to be high enough to allow the girders and piers to be handled between spans 36W and 41W. However, this access provides less flexibility for the deconstruction of the foundations and the laying of the piers, which will be between the Existing Bridge and the New Bridge, which is not easy to do.

Photo 5 – Highway 25 Bridge: Overhead gantry for approach spans

Photo 6 – Highway 25 Bridge: Two lifting gantries running on rails

2.1.1.2.2 Reuse of materials from the New Bridge jetties

The construction of the New Bridge required the creation of several jetties: the West jetty on the Nuns' Island side (seen on Figure 2), the jetty under the cable-stayed bridge (Figure 3) on the Seaway dike, and the East jetty, made up of a jetty near the Seaway and another one in Brossard (Figure 4). Based on the information provided by SSL, the available tonnages from the three existing jetties are roughly 925,000 metric tonnes.

The possibility of reusing materials from the New Champlain Bridge jetties becomes a viable option, given the quantities involved. In a context of sustainable development where cost, the environment and the social component are three aspects to consider in any decision-making, the reuse of materials seems, in fact, to be the preferred option. The reuse of materials allows truck transport mileage to be significantly reduced. This results in major environmental (e.g. reduction in GHG emissions) and social benefits (e.g. reduction in transportation-related disturbances for local residents, including dust and noise).

These materials will be available in fall 2019. JCCBI took steps with SSL to acquire part of these materials. The materials originating from the New Bridge jetties will be removed and stored in areas D and E, and grouped by type of materials. A physico-chemical characterization will first be done to ensure they are not contaminated. These materials will be made available to the contractor in charge of bridge deconstruction.

There are certain drawbacks to storing materials, such as the volume of materials to be stored is considerable and several nearby sites would have to be used, which would generate noise and dust for local residents during storage operations. Appendix 14 provides clarifications in this respect.

However, since the storage sites are located nearby (areas D and E), the effects on the local network will not be as great as bringing in new materials from outside. In addition, this scenario would enable the contractor chosen for the deconstruction to build the jetty based on its actual needs related to method it will have chosen.

Although the reuse of part of the materials is the preferred option, there may not be enough of certain types of materials, according to the design and the contractor's needs, and the materials may have to come from an external source.

2.1.2 MOBILIZATION AREAS AND POTENTIAL DISMANTLEMENT SITES

The mobilization areas and potential dismantlement and handling sites that are available, which are under JCCBI's jurisdiction, are presented below. Based on the deconstruction methods recommended and described in the sections that follow, the following dismantlement and handling sites will be required:

- A – Nuns' Island site;
- B – Seaway dike site;
- C – Brossard site north of Highway 132;
- D – Brossard site south of Highway 132;

A fifth site (site E) has been added. More details on this are provided in Appendix 14.

These intermediate sites (between the bridge and the final destination of the materials) are required so that the materials can be dismantled into pieces of appropriate size for each of the methods of transportation being considered. The sites will namely be used to sort the various materials, crush the concrete, and for handling for transportation. For this scenario, these four sites would thus be large enough to handle the dismantlement of the entire structure, in the event this option is selected by the contractor. A fifth site ("E") will be used only to temporarily store materials that will be recovered from the SSL jetties and to install work site trailers. Appendix 14 presents the characteristics of this site along with the effects of its use and the applicable mitigation measures.

Sites A, B and C include a land portion and a water portion. Access by land (without a barge) is possible for the bridge sections located over land, or by jetty for the areas near Nuns' Island, the Seaway Dike or Brossard on the South Shore. The three proposed temporary jetties in these sections constitute a work area near the bridge for deconstruction purposes and for dismantling and handling materials. These areas also allow transportation by water over short distances in the bridge area. Site D is entirely on land.

Regarding the transport of elements to be dismantled, the areas slated for deconstruction can be grouped by dismantlement and handling site, as shown in Table 3. It is important to mention that this distribution is preliminary and better suited to the dismantlement of piers, pier shafts and footings, since the choice of site for the deck will depend on the deconstruction method. In fact, if a launching gantry is used for the concrete deck beams, the beams could be transported and dismantled at the same site and not spread out over the four sites.

The contractor may also decide to ship entire elements by water or by road to sites outside the JCCBI mobilization areas. However, this is not the preferred option at this stage of the studies.

Table 3 – Dismantlement and handling sites

AREA	SPANS (AXES)	TRANSPORT METHOD TO HANDLING SITE	DISMANTLEMENT AND HANDLING SITES
5-1	44W to 41W	Land	A
5-2	41W to 36W	Land (jetty)	A
5-3, 6-1 and 6-2	36W to 0.5W	Water or land, if there is a jetty (1W to 5W)	B
6-3	0.5W to 0.5E	Seaway	B or C
6-4, 6-5 and 7-1	0.5E to 4E	Water	C
7-1	4E to 8E	Water or land, if there is a jetty	C
7-2	6E to 10E	Land	C
7-2	10E to 14E	Land	D

2.1.2.1 Nuns' Island – Dismantlement and handling site "A"

On the Nuns' Island (IDS) side (north shore), a mobilization area is available along the road leading to the Champlain Bridge Ice Control Structure (Figure 5). However, redevelopment work was done at the Ice Control Structure approaches, which limits the available area. This area does not provide any direct access to the water,

The section of the Existing Champlain Bridge on Nuns' Island (IDS) that is over land between spans 44W and 41W (area 5-1) allows deconstruction to be done directly from the ground. In this area, the materials resulting from deconstruction will likely be dismantled or demolished, crushed in bulk, and inventoried for transport directly outside of the work area (Figure 5).

For the deconstruction of the spans between axes 41W and 35W (area 5-2), a temporary jetty that is slightly smaller than the one that was created for the New Champlain Bridge, must be built because this area cannot be directly accessed by barge due to the low draught. Like the preceding area (44W to 41W), there must enough space on the jetty to enable deconstruction directly from the ground, the handling of materials, loading, and truck movement.

This bridge section along Nuns' Island is particularly restricted and the lack of space could be a problem if the contractor proposed to remove most of the concrete girders using unlaunching in this area. The selected contractor will thus be required to refine the options at the next engineering stages in order to confirm how much space is available in relation to the New Bridge, determine the actual surface area of the temporary jetty, and define the traffic routes of trucks coming from the Ice control Structure during the project.

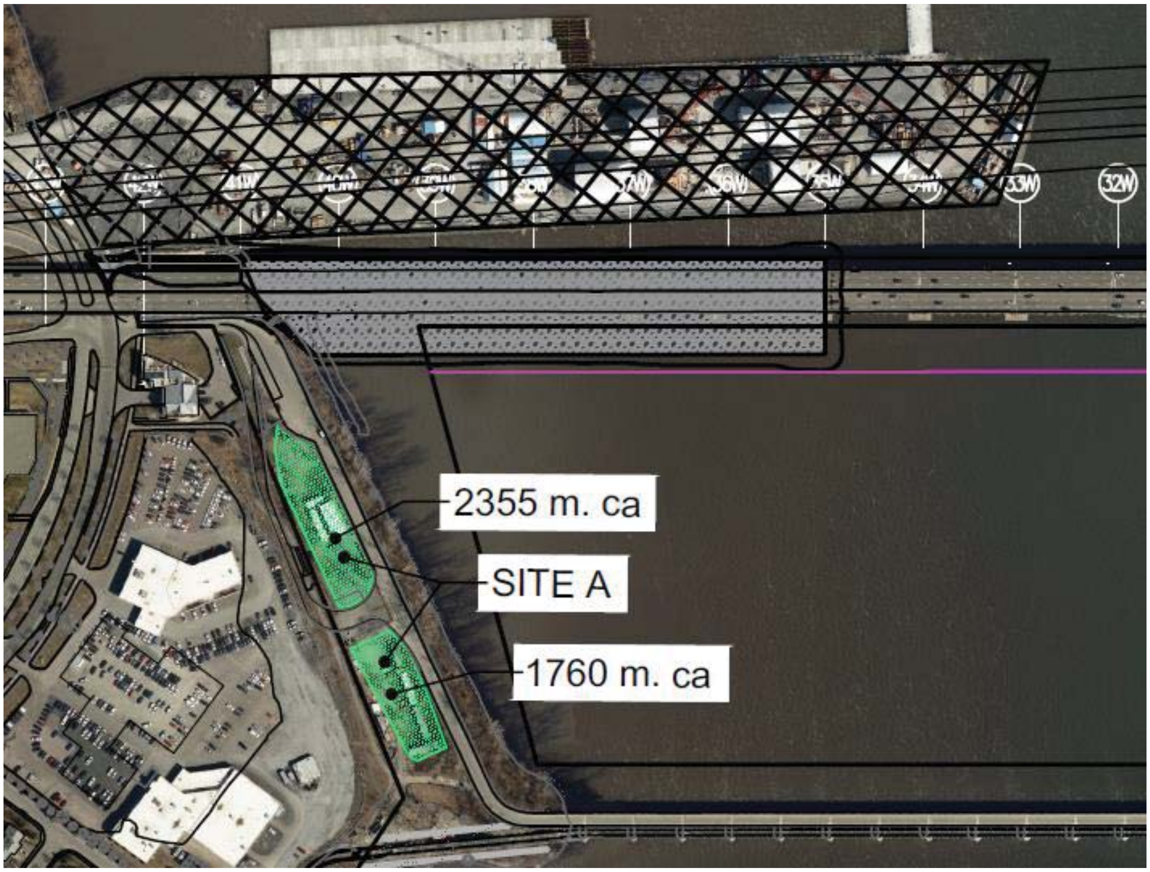


Figure 5 – Dismantlement and handling site "A" – Nuns' Island

2.1.2.2 Seaway dike – Dismantlement and handling site "B"

This mobilization area is located at the base of pier 1W on the St. Lawrence Seaway dike. It is currently used for maintenance work on the Existing Champlain Bridge and can be accessed by road via the Champlain Bridge Ice Control Structure. It is a private road under the jurisdiction of JCCBI. The dike can also be accessed by the river, and various docks have been set up there (Figure 6). This area is dismantlement and handling site "B."

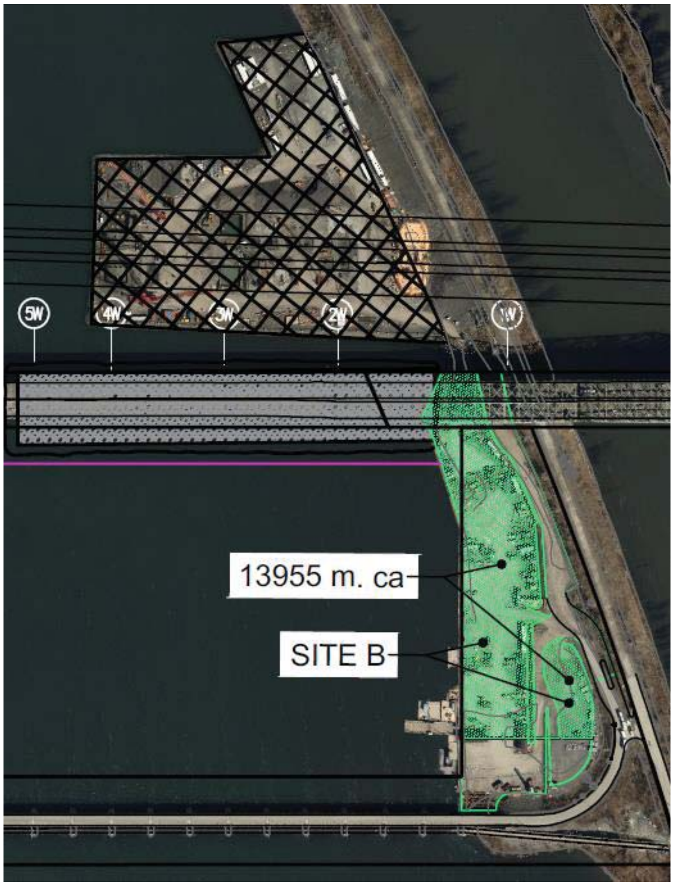


Figure 6 – Mobilization area and dismantlement and handling site "B" – Seaway dike

The location of this site is of particular note since it is relatively far away from residential areas and the noise generated by materials handling will therefore be less noticeable. The current plan is to use barges to create a work area over water in order to transport and support deconstruction equipment (i.e. cranes), and to receive the materials, components (e.g. trusses, beams) and deconstruction debris.

Dismantlement site "B" will be used for the following:

- Berthing the barges used for deconstruction;
- Serving as a dismantlement and handling centre;
- Receiving and loading the highway trailers;
- Receiving and loading river barges to transport materials to ports such as Montreal, Contrecœur, Trois-Rivières and Valleyfield.

2.1.2.3 Brossard – Dismantlement and handling site "C"

Two mobilization areas are available on the South Shore side. The first is located between axes 6E and 9E north of Highway 132. A dock was set up that allows access to the Small La Prairie Basin. This area is dismantlement site "C."

The deconstruction of bridge spans 4E to 6E can be done on a temporary jetty, as shown on Figure 7, in the same way as for the Nuns' Island shoreline area or on barges. The land section between axes 4E and 10E will normally be dismantled using the standard method with excavators. This site will be fully used to handle materials that will be transported in view of being demolished or dismantled, crushed in bulk, and inventoried for transport.

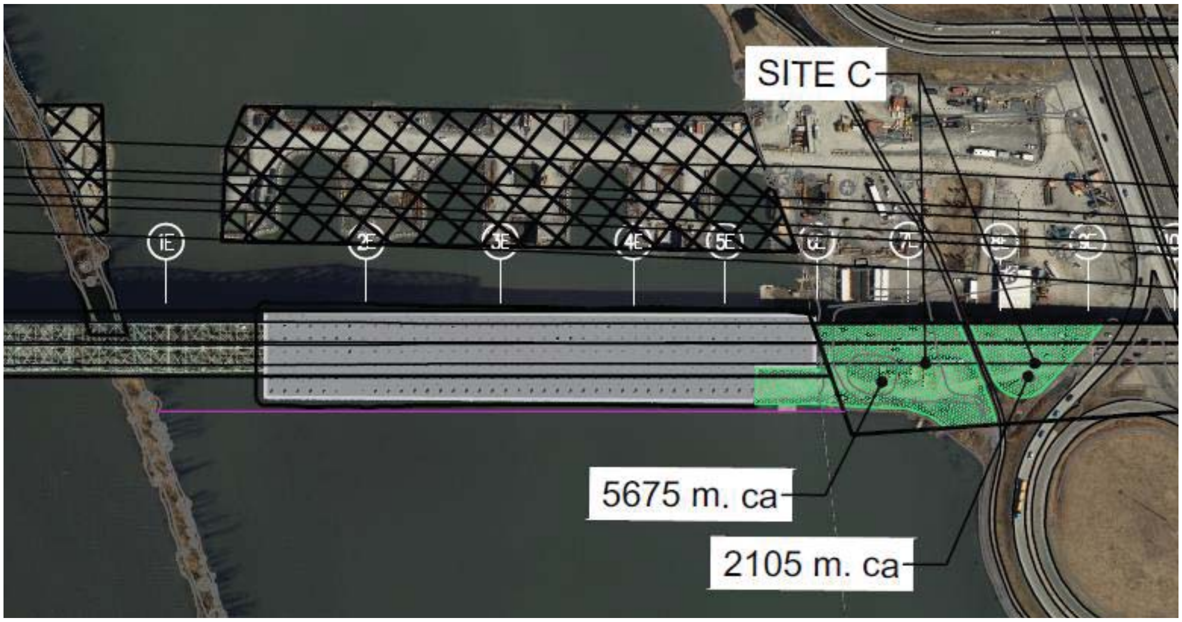


Figure 7 – Mobilization area and dismantlement and handling site "C" – Brossard

2.1.2.4 Brossard – Dismantlement and handling site "D"

The second mobilization area, on the South Shore, is located inside the highway onramps, south of Highway 132 (Figure 8). This area is dismantlement and handling site "D." This area could provide access to the bridge deck by road.

The section of the Existing Champlain Bridge over land in Brossard above and south of Highway 132 between spans 10E and 14E allows standard deconstruction to be carried out directly from the ground. A surface area of about 10,000 m^2 is considered for handling deconstruction materials and crush the concrete. However, the entire available surface area should probably be used since work site facilities and a storage area are also needed. This area would also be temporarily used to store part of the materials originating from the jetties used in the construction of the New Champlain Bridge until they are used by the contractor in charge of deconstruction.

Figure 8 – Mobilization area and dismantlement and handling site "D" – Brossard

2.1.3 DECONSTRUCTION SCENARIOS

During the draft-design study, several usual methods were reviewed by including the specific constraints of the Existing Champlain Bridge.

The following methods are considered for deconstruction:

- Preparatory work
- Deck – Concrete spans:
  - Unlaunching (T2)
  - Standard demolition and removal by crane (T1).
- Deck – Metal spans:
  - Cranes/Balanced cantilever/Lifting (TA1)
  - Reverse erection (TA2)
- For pier caps and pier shafts:
  - Conventional demolition/sawing (S1)
- For footings:
  - Controlled explosion (S2) – not permitted by JCCBI;
  - Conventional demolition/sawing (S1)

A description of each method is found below. The recommended mobilization areas along with the required equipment are also specified.

2.1.3.1 Preparatory work

Preparatory work includes deconstruction activities that involve any element other than the main structural elements. This work basically involves the following stages:

1. Remove lights, road signs, lane traffic lights and any other equipment.
2. Remove asphalt;
3. Remove rails (it is the contractor's decision whether to remove them as the work progresses or all at the same time).
4. Remove span expansion joints (it is the contractor's decision whether to remove them as the work progresses or to remove them all and install plates to permit work site vehicles to access the site).
5. Install work site barriers (if needed).
6. Use conventional measures to prevent the fall of debris or materials (protect waterways, the Seaway, crossings, etc.).
7. Set up conventional measures to prevent workers from falling.

For preparatory work, access is via the deck for all areas.

2.1.3.2 Deck – Concrete spans

The scenarios for the deconstruction of the concrete span deck are presented below. Note that about 100 beams on the Existing Champlain Bridge have been reinforced with carbon fibre sheets, and crushing operations along with the layout of these materials must comply with applicable laws, regulations and guidelines. However, precautions must be taken with sawing dust (similar to the precautions for silica dust created from concrete sawing – see sections 6.3.4 and 6.4.1.6 in Volume 2).

2.1.3.2.1 Unlaunching (T2)

Scenario T2 consists in using a standard launching gantry to remove the concrete girders (Table 4). This technique can be used for all the concrete girders. However, the first span (44W-43W) on the Nuns' Island side will likely be dismantled with the standard method, since the shoring under the girders will make it easier.

Table 4 – Scenario T2

AREA	METHOD	ACCESS	TYPE OF TRANSPORT	MOBILIZATION AREA
5-1	Unlaunching	By the deck	Self-propelled modular trailer	Site B (VM dike) or site D (Brossard)
5-2				
5-3				
7-1				
7-2				

The unlaunching method stems directly from the method used to build the current bridge structure, as well as for many works of this type, by "inverting" the construction process using a metal frame called a "launching gantry." The principle consists of separating the girders, such as by sawing the middle slab and crossbeams, before they are picked up by the launching gantry. Launching gantries are generally made up of two main interwoven steel trusses (Photo 7). Their total length is close to twice the span to be crossed.

Photo 7 – Launching gantry

The weight of the launching gantry may constitute a disadvantage since it must be supported by the structure. However, the standard designs avoid having the launching gantry rest on the deck when in motion and when handling girders. As shown in Figure 9, the launching gantry stands on two or three supports, depending on the project phase, and is supported at the piers.

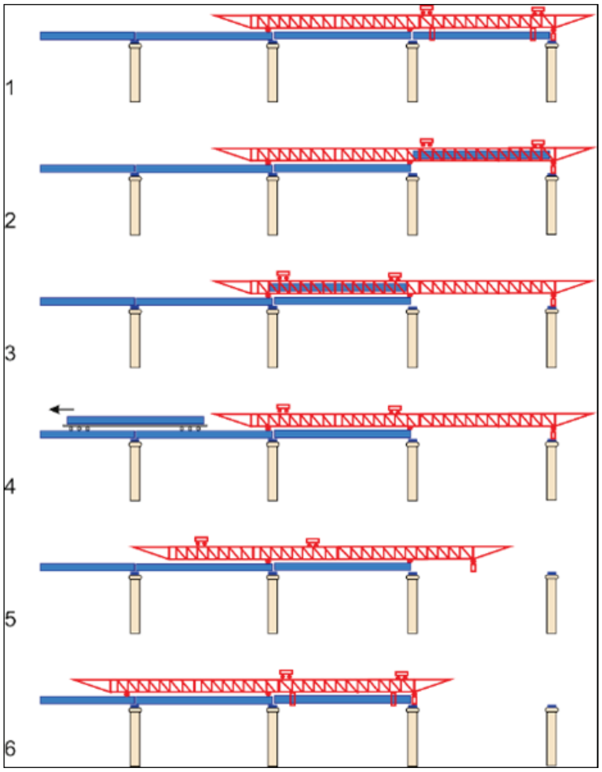


Figure 9 – Unlaunching sequence

With scenario T2, mobilization areas "B" or "D" can be used for on-site dismantlement. The space in these areas allows enough girders to be piled so as to not decrease the optimal pace of the launching gantry, which is one to two girders per day.

2.1.3.2.2 Standard demolition and removal by crane (T1)

This scenario mainly consists of two methods: standard demolition and removal by crane. For this scenario, when there are optimal conditions of use for the standard method, the latter is used. When conditions are more difficult, removal by crane is used. Table 5 summarizes the methods selected for each area.

Table 5 – Scenario T1

AREA	METHOD	ACCESS	TYPE OF TRANSPORT	MOBILIZATION AREA
5-1	Standard	By land	Truck	Site A (Nuns' Island)
5-2	Removal by crane or with the standard method (if there is a jetty)	By jetty/floating wharf	Trucks or barges	Site A (Nuns' Island)
5-3	Removal by crane	By barge	Barges	Site B (dike VM) or offsite (transport directly by barge)
7-1	Removal by crane or with the standard method (if there is a jetty)	By barge/jetty/floating wharf	Trucks or barges	Site C (Brossard) or offsite (transported directly by barge)
7-2	Standard	By land	Trucks	Site C or D (Brossard)

2.1.3.2.2.1 Standard method

The standard method could be used for the concrete spans that are on the ground (areas 5-1 and 7-2). Standard demolition techniques are presented in more detail in the section on pier cap and pier shaft deconstruction (section 0).

2.1.3.2.2.2 Removal by crane

The use of cranes to remove from one to three girders at a time is a technique suited to the Existing Champlain Bridge. The number of girders that can be simultaneously removed will naturally depend on the capacity of the cranes and their availability. The slab between the girders should first be cut so that the girder or group of girders can be lifted. The cranes can be set up on land, a jetty or barges, and the elements are placed on a barge or self-propelled modular trailer (on the ground or the jetty). Other barges can go up the river to take the girders to an off-site location or to the available mobilization sites. The demolition of the girders at the available mobilization sites should adapt well to the time required for the crane-based dismantling operations, enabling efficient planning. There is no specific requirement to work in a particular sequence. The contractor can make optimal use of its own resources and work on several concrete spans at a time.

Access is from the ground (areas 5-1 and 7-2), from a jetty (area 5-2) and by barge (areas 5-3 and 7-1).

2.1.3.3 Deck – Steel spans

The scenarios for the deconstruction of the steel span deck are presented below.

2.1.3.3.1 Cranes/Balanced cantilever/Lifting (TA1)

Scenario TA1 is a combination of several methods. Table 6 summarizes the methods selected for each area.

Table 6 – Scenario TA1

AREA	METHOD	ACCESS	TYPE OF TRANSPORT	MOBILIZATION AREA
6-1	Lifting of trusses in pairs	By barge	Barges	Site B (dike VM) or offsite (transport directly by barge)
6-2	Reverse erection with balanced cantilever	Using a temporary support	Barges	Site B (dike VM) or offsite (transport directly by barge)
6-3	Strand jack lowering	By barge	Barges	Site B (dike VM) or offsite (transport directly by barge)
6-4	Reverse erection with balanced cantilever	Using a temporary support	Barges	Site C (Brossard) or offsite (transported directly by barge)
6-5	Lifting of trusses in pairs	By barge	Barges	Site C (Brossard) or offsite (transported directly by barge)

2.1.3.3.1.1 Lifting of suspended span (area 6-3)

The lifting method is used to remove large sections of the bridge. Although a fair amount of preparation may be required to lift the spans, the actual lifting operations can be done fairly quickly. The bridge's main span was built in such a way as to allow the suspended span to be lifted with stranded-wire jacks with few structural alterations.

For the Existing Champlain Bridge main span structure, the suspended span is designed as an independent unit that is suspended at the end of the cantilever structures. Stranded-wire jacks would be placed at the end of the cantilever spans and the wires would also be anchored at the ends of the suspended span trusses. The suspended span would be removed from the main structure and placed on a barge below. Two examples are shown in Photo 8 and Photo 9.

Source: courtesy of Foothills Bridge Co (photo by Jakub Mosur).

Photo 8 – Lowering of Carquinez Bridge suspended span

Source: courtesy of Foothills Bridge Co (photo by Sam Burbank).

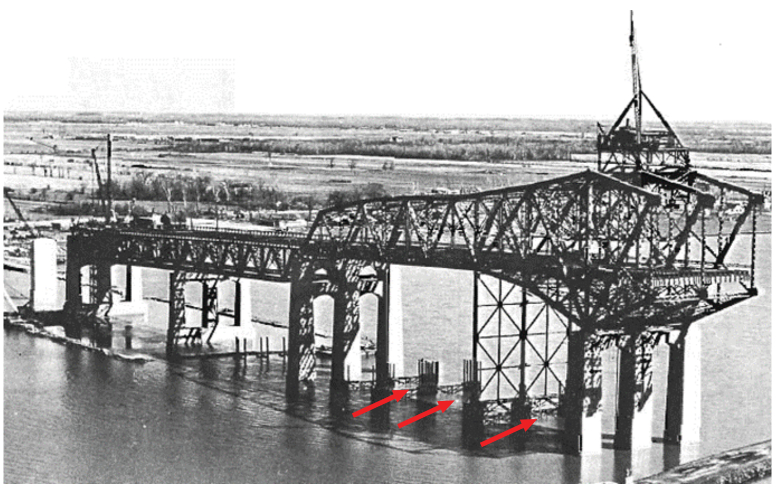
Photo 9 – Oakland Bay Bridge in San Francisco – Removal of 504-foot span

With respect to the mobilization areas and required equipment, there is a variety of access routes under the main span, including shallow water, the St. Lawrence Seaway, and the Seaway Dike. The suspended span would require the use of barges on the Seaway. The size of this span would likely limit the distance over which it can be transported along the Seaway. The suspended span would probably be dismantled in the basin adjacent to the Seaway or in one of the nearby mobilization areas.

2.1.3.3.1.2 Reverse erection of anchor and cantilever spans (areas 6-2 and 6-4)

The bridge was built using temporary bents and light derricks operating on the deck of the partially built structure. The reverse erection method consists in following the initial sequence used to erect the anchor span and cantilever trusses backwards. It will thus involve progressive dismantling using temporary bents in the anchor spans when required. Use of heavier equipment will probably be limited with respect to the sections of the structure that will not be supported by temporary bents (cantilever sections). However, the contractor may decide to modify the bridge to allow heavier equipment to be used on the cantilever spans, or choose another deconstruction method for this section.

The main span was originally constructed by systematic assembly, starting with the piers at the anchor spans (2W and 2E), and heading toward the middle of the main span. Three temporary bents supported each anchor span to support the trusses while they were being built up to piers 1W and 1E and in the cantilever span (Figure 10).



Source: Le Pont Champlain: une histoire photographique, by Hans Van Der Aa.

Figure 10 – Construction of the main span of the Champlain Bridge; the foundations of the three temporary bents can be seen

Construction of the trusses continued until the middle of the suspended span, with two long cantilever sections meeting in the middle. Lifting operations were required to pivot the suspended span, releasing it from the cantilever span on the main span structure, such that it would be only supported by the suspensions at each end of the cantilever sections. Once the main span truss structure was completed, a concrete deck was added over the entire length. Note that this original concrete deck and longitudinal girders were subsequently replaced with a lighter steel orthotropic deck, which will have to be removed before the main span trusses are taken down.

The reverse erection method for the entire main span is shown in Figure 11.

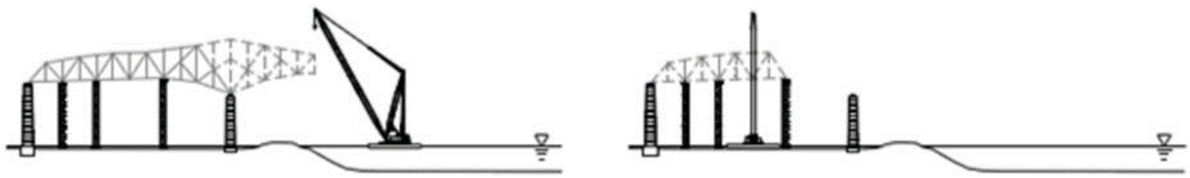


Figure 11 – Section 6 – Reverse erection of main span

With the reverse erection method, deconstruction can be done from the bridge deck or from the water or ground below. There are a number of ways to access the bottom of the main span including shallow-water areas, the St. Lawrence Seaway, and the Seaway dike. Thus, if reverse erection were done by working under the structure, a temporary jetty would be required along with low-draught barges, cranes mounted on barges, or other means. The bridge sections could be handled on site or transported by barge or truck to offsite facilities.

The available mobilization areas are compatible with this method; like the South Shore (site "C"), the Seaway dike (site "B") has enough space to store the metal parts. In addition, if parts are hauled away directly by barge to an off-site area, there is even less of a space problem.

2.1.3.3.1.3 Approach spans – Lifting trusses in pairs (areas 6-1 and 6-5)

For the deconstruction of the approach spans made up of steel trusses (sections 6-1 and 6-5), lifting is the recommended method for removing the trusses from their supports. Similar to hoisting the suspended span with jacks, lifting trusses also allows large sections of the bridge to be removed. Lifting a full span was not chosen, however, because of the complex manoeuvres required. Lifting the trusses is the recommended method, and it requires that the steel orthotropic deck of the approach spans be removed first.

The lifting operation would require either a marine crane installed in the water (Photo 10) or a land-based crane installed on a jetty. The size of the crane will determine whether the trusses will be lifted individually or in pairs. Lifting the trusses in pairs is preferred as this is usually the more stable method from a structural standpoint, but a larger crane is required with more complex attachments. Before removing the trusses in pairs, it must be determined whether they have the required capacity. An additional support crane would be needed to remove the trusses individually in order to support the last truss while the one before that is removed. Refined treatment by the chosen contractor will be required to determine whether the trusses can be individually removed.

Source: Foothills Bridge Co.

Photo 10 – Deconstruction of Hood Canal Bridge

The approach spans are located over a shallow-water area of the basin and St. Lawrence River. Access will be limited when installing the two cranes needed to remove the last two separate beams. The contractor must also take into account the location of the New Bridge in relation to the Existing Champlain Bridge to determine where to set up the cranes.

2.1.3.3.2 Reverse erection (TA2)

This scenario consists in fully dismantling the bridge's main suspended span and the approach spans using the reverse erection method. Table 7 summarizes the scenario for each area.

Table 7 – Scenario TA2

AREA	METHOD	ACCESS	TYPE OF TRANSPORT	MOBILIZATION AREA
6-1	Reverse erection	Temporary supports (equipment on the structure)	Barges	Site B (dike VM) or offsite (transport directly by barge)
6-2		Temporary supports (equipment on the structure)	Barges	Site B (dike VM) or offsite (transport directly by barge)
6-3		(Light equipment on the structure)	Barges	Site B (dike VM) or offsite (transport directly by barge)
6-4		Temporary supports (equipment on the structure)	Barges	Site C (Brossard) or offsite (transported directly by barge)
6-5		Temporary supports (equipment on the structure)	Barges	Site C (Brossard) or offsite (transported directly by barge)

Since this reverse erection method was presented for recommended scenario TA1, it will not be described in detail in this section.

2.1.3.4 Piers – Pier caps and pier shafts

The pier cap and pier shaft deconstruction scenarios are presented below.

2.1.3.4.1 Standard demolition and sawing (F1)

This scenario mainly consists of two methods: standard demolition and sawing. Used when all optimal conditions for the standard method are present. When conditions are more difficult, sawing is preferred. Table 8 summarizes the methods selected for each area.

Table 8 – Scenario F1

AREA	METHOD	ACCESS	TYPE OF TRANSPORT	MOBILIZATION AREA
5-1	Standard	By land	Truck	Site A (Nuns' Island)
5-2		By jetty/floating wharf	Trucks or barges	Site A (Nuns' Island)
5-3	Sawing	By barge	Barges	Site B (dike VM) or offsite (transport directly by barge)
6-1/6-2		By barge	Barges	Site B (dike VM) or offsite (transport directly by barge)
6-4/6-5		By barge/jetty/floating wharf	Trucks or barges	Site C (Brossard) or offsite (transported directly by barge)
7-1	Conventional (if there is a jetty)	By barge/jetty/floating wharf	Trucks or barges	Site C (Brossard) or offsite (transported directly by barge)
7-2	Standard	By land	Trucks	Site C or D (Brossard)

2.1.3.4.1.1 Standard method

This is the standard method used to demolish a structure. It uses standard equipment and techniques which contractors are generally very familiar with. This method is used for the demolition of above-water pier caps and pier shafts no more than about 15 m high.

Among the usual techniques used with the standard method (Photo 11), those being considered include hydraulic and pneumatic hammers, concrete crushers with shear jaws, and sawing. Some technologies are only suitable for partial demolition and cannot be considered effective for full demolition, especially given the size of the Existing Champlain Bridge. Hydrodemolition, splitting and thermal cutting and drilling could be used, but in specific cases. Wrecking balls and cranes are also not being considered on a large scale as there is less control with this type of demolition.

Source: Walsh Construction 2016 (www.walshgroup.com/).

Photo 11 – Conventional barge method used for the demolition of the Long Island Bridge in Boston Harbor

Figure 12 illustrates the principle of standard demolition applied to a Champlain Bridge pier.

The projected access is from the ground for areas 5-1 and 7-2 and from a temporary jetty for area 5-2.

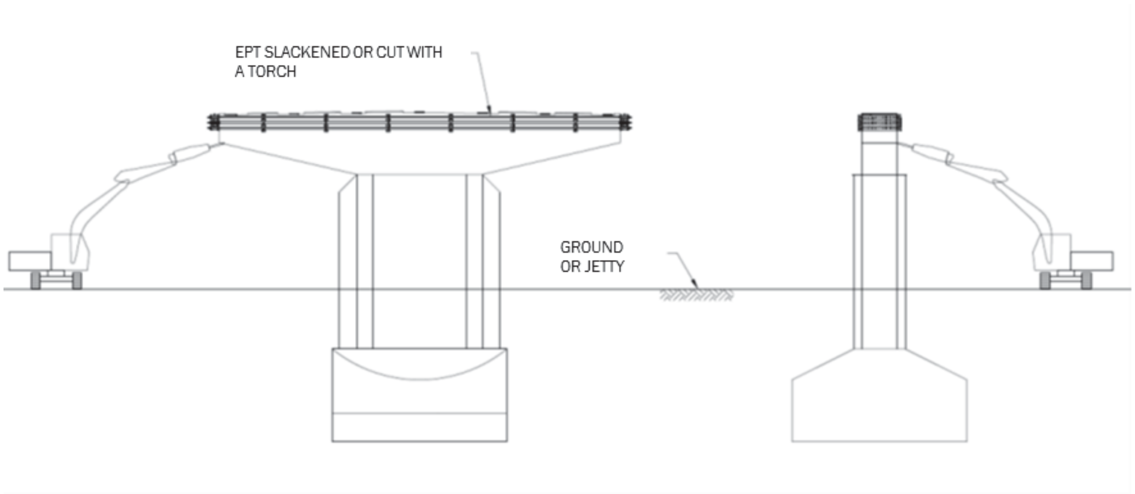


Figure 12 – Standard method – Foundations over land – Front and side views

The currently available mobilization areas are sufficient for this method to be used. The cranes and shovels are of standard size and do not require any particularly large spaces.

2.1.3.4.1.2 Sawing and removal by crane

The use of cranes to remove key pieces from piers and pier caps is the recommended solution for taller piers (Figure 13 and Figure 14). The cranes can be installed on barges and other barges can go upstream to deposit the pier pieces off-site or to the available mobilization sites. Element demolition at the available mobilization sites should adapt well to the pace of the crane dismantling operations, thus making efficient planning possible.

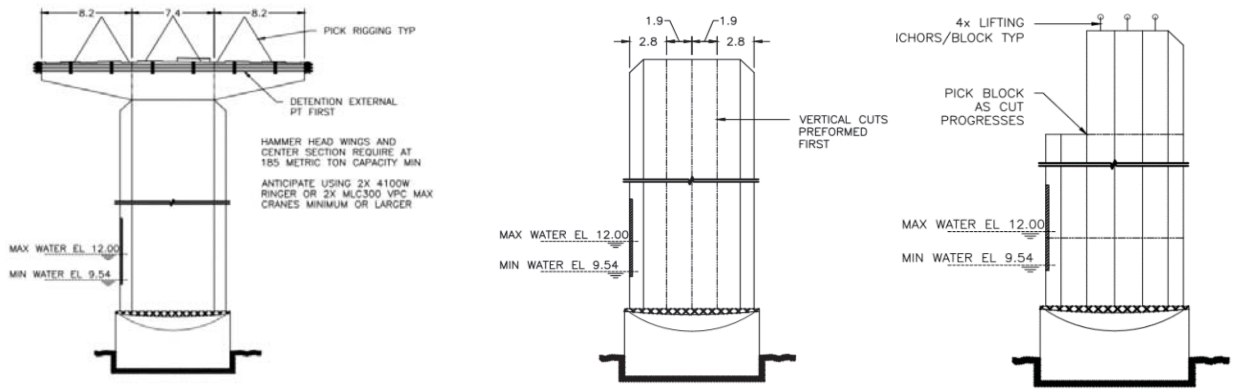


Figure 13 – Section 5 – Pier sawing

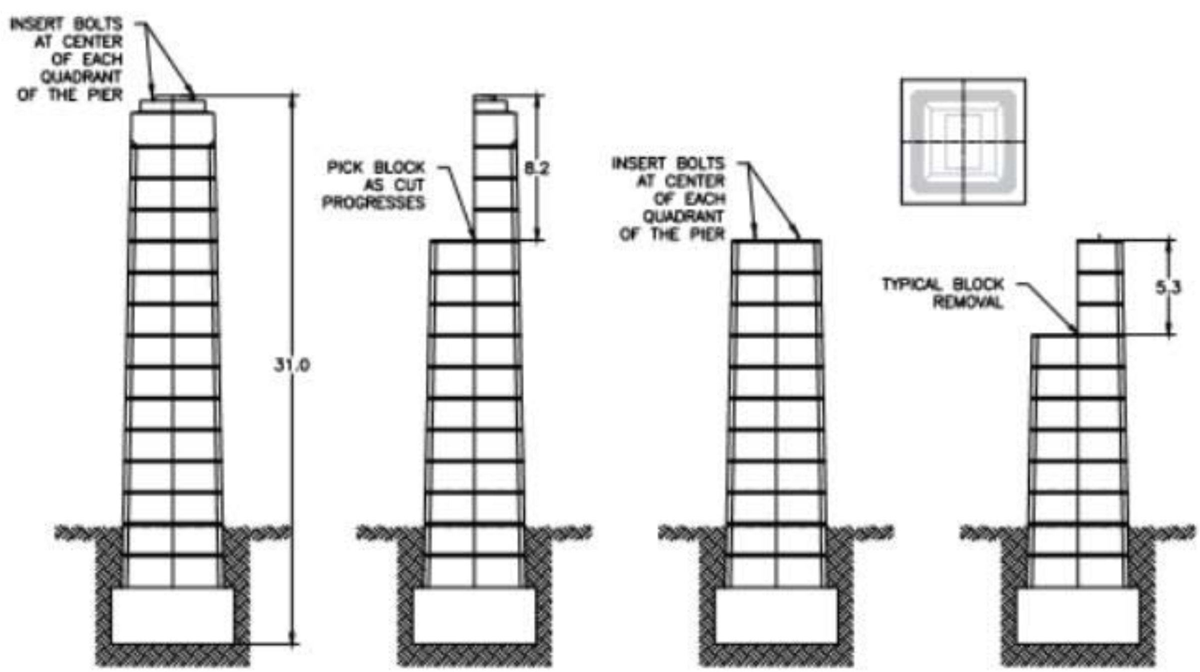


Figure 14 – Section 6 – Pier sawing

Access is by barge for the river and the Seaway dike (zones 5-3 and 7-1). The cranes needed to lift the girders and the pier caps are not standard cranes. They must have a capacity of 500 to 1,000 t, depending on the options that are chosen. This equipment is not particularly difficult to obtain, although it does require the use of companies specialized in heavy lifting.

The available mobilization areas are compatible with this method; the Seaway dike and Brossard areas have enough space to store the pier caps, pier shafts and foundation components. In addition, if parts are hauled away directly by barge to an off-site area, there is even less of a space problem.

2.1.3.5 Pier - Footings

The footing deconstruction scenarios are presented below. The level of footing demolition is also covered since it will affect the methods that are chosen.

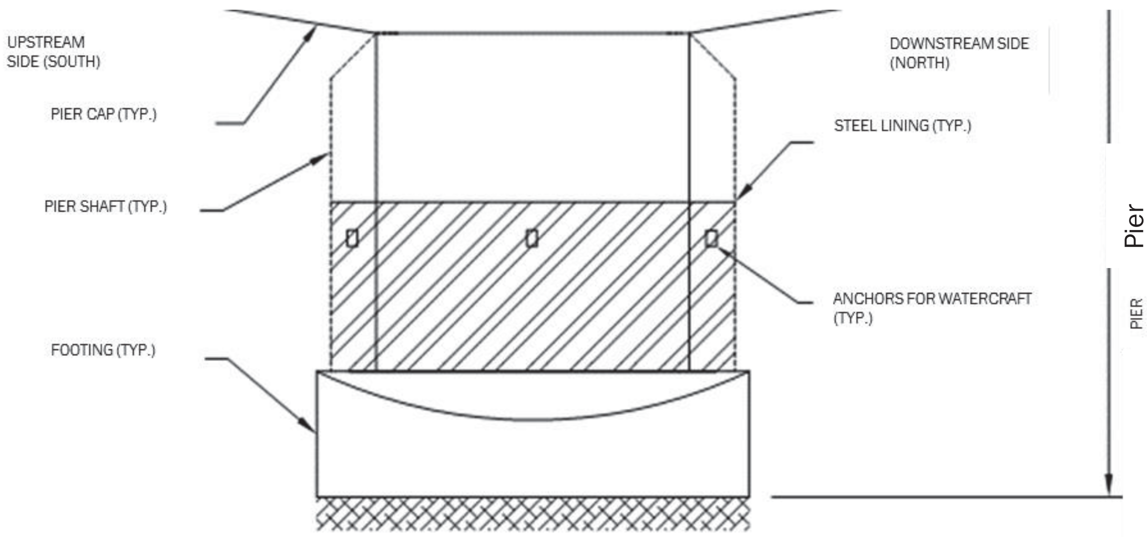


Figure 15 – Footings in sections 5 and 7

2.1.3.5.1 Level of footing demolition

Following the open house in May 2019 (see Chapter 4, Volume 2) and suggestions made by participants, an analysis was done to determine the piers and footings that could be kept on site for enhancement purposes. It was determined that the piers in water (40W and 39W) and the piers on land (41W, 1W and 7E) would be partially kept for enhancement purposes (Map 2). A 6-m high portion of the two piers in water will be kept.

Besides piers 40W and 39W, all the other piers (and footings) in the Greater La Prairie Basin will be dismantled to a depth of 450 mm below the elevation of the river bed. The piers (and footings) in the Lesser La Prairie Basin will be dismantled to the bedrock. This meets the requirements of the SLSMC and TC.

2.1.3.5.2 Standard method and controlled explosion

The 2017 draft-design prepared by PTA provides for a scenario (S2) where controlled explosion is proposed. JCCBI subsequently indicated, when the call for qualification for the deconstruction of the

Existing Champlain Bridge was announced in March 2019, that the use of controlled explosion would not be permitted for the structure and the piers (including the pier caps, pier shafts and footings). This method is nevertheless presented as a deconstruction method for the footings.

Scenario S2 consists in using the standard method to demolish the footings accessible by land (areas 5-1, 5-2 and 71) and controlled explosion for all the others. Table 9 summarizes the methods selected for each area.

Table 9 – Scenario S2

AREA	SPANS	METHOD	ACCESS	TYPE OF TRANSPORT	MOBILIZATION AREA
5-1	41W to 44W	Standard	By land	Truck	Site A (Nuns' Island)
5-2	36W to 41W		By jetty/floating wharf	Trucks or barges	Site A (Nuns' Island)
5-3	4W to 36W	Controlled explosion	By barge	Barges	Site B (dike VM) or offsite (transport directly by barge)
6-1	2W to 4W	Non-demolished footings	Non-demolished footings	Non-demolished footings	Non-demolished footings
6-2	0.5W to 2W	Non-demolished footings (except 1W = standard)	1W: By land	1W: Truck	1 W: Site B (dike VM)
6-4/6-5	0.5W to 4E	Non-demolished footings	Non-demolished footings	Non-demolished footings	Non-demolished footings
7-1	4E to 8E	Conventional (if there is a jetty)	By barge/jetty/floating wharf	Trucks or barges	Site C (Brossard) or offsite (transported directly by barge)
7-2	6E to 14E	Standard	By land	Trucks	Site C or D (Brossard)

2.1.3.5.2.1 Standard method

The standard method will be used for the deconstruction of footings on land. This method is the same as the one described in the section on pier caps and pier shafts. Figure 16 shows the case of a footing on a jetty

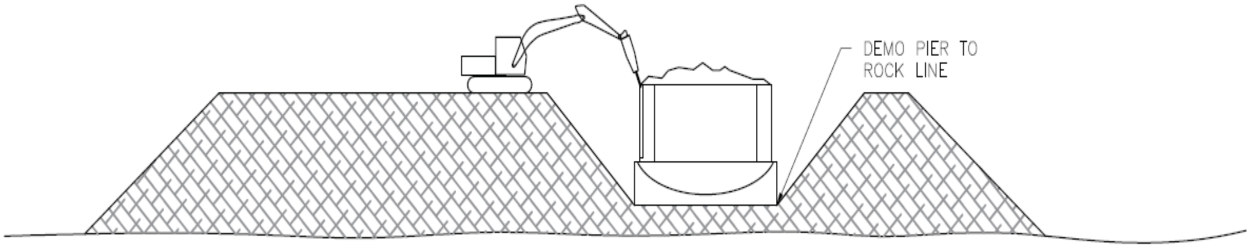


Figure 16 – Standard demolition of a footing on a temporary jetty

Ponts JACQUES CARTIER • CHAMPLAIN Bridges Canada

Location

Ground level

In water

Level of demolition

Pier and footing to keep for enhancement

Pier and footing to be demolished

DECONSTRUCTION OF ORIGINAL CHAMPLAIN BRIDGE (2017-2022)
CONTRACT No. 62555
MONTREAL, QUEBEC

Suggested level of demolition for piers and footings

September 2019

Coordinate system: NAD83 MTM 8

Base maps: Google 2018

Parsons Tetra Tech Amec Foster Wheeler

Map 2

\\TTS350FS2\prj_reg\36118TT\DOC-PROJ\60\60CRO\ArcGIS_ArcMap\36118TT_Map2_DemolitionLevel_20190926.mxd

2.1.3.5.2.2 Controlled explosion for underwater footings

Demolition using controlled explosion is the method recommended in the draft-design study for underwater footings. The explosives are adapted to the Existing Champlain Bridge, and the method takes into account the proximity of the New Champlain Bridge. The demolition is highly controlled, and it is possible to demolish very close components, as is virtually always the case for explosion demolitions of buildings in urban areas.

Footings could be broken up using explosives (controlled explosion), after which excavators can be used to remove the components. The use of excavators is feasible for the footings outside of water as well as in-water footings by placing excavators on the shore, on a temporary jetty or on barges.

Given the anticipated impacts during controlled explosions, mitigation measures for the protection of fish are required. The identified measures consist of:

- Cofferdams around the footings: by pumping water into the cofferdam, the shockwave from the explosion is no longer directly transmitted to the water around the cofferdam.
- A bubble curtain, used to dampen the shockwave transmitted into the water.
- Use of scare charges to scare off fish in the affected area.

The advantage of this demolition method is that it minimizes in-water work time compared to other possible methods. There are enough available mobilization areas for storing the excavators and debris. The required equipment will consist of means of access (such as barges for the piers) and corers to set up the explosives. Excavators will then be needed to pick up the debris.

However, the requirements for explosives to be authorized (controlled explosion) could be very restrictive, so this method will likely not be retained. JCCBI thus indicated, when the call for qualification for the deconstruction of the Existing Champlain Bridge was announced in March 2019, that the use of explosives (controlled explosion) would not be permitted for the structure and piers (pier caps, pier shafts and footings).

2.1.3.5.3 Standard demolition and standard demolition using a cofferdam

This scenario includes sawing the underwater footings rather than demolition using controlled explosion. Table 10 summarizes the methods selected for each area.

Table 10 – Scenario S1

AREA	SPANS	METHOD	ACCESS	TYPE OF TRANSPORT	MOBILIZATION AREA
5-1	41W to 44W	Standard	By land	Truck	Site A (Nuns' Island)
5-2	36W to 41W		By jetty/floating wharf	Trucks or barges	Site A (Nuns' Island)
5-3	4W to 36W	Standard with cofferdam	By barge	Barges	Site B (dike VM) or offsite (transport directly by barge)
6-1	2W to 4W	Non-demolished footings	Non-demolished footings	Non-demolished footings	Non-demolished footings
6-2	0.5W to 2W	Non-demolished footings (except 1W = standard)	1W: By land	1W: Truck	1 W: Site B (dike VM)
6-4/6-5	0.5W to 4E	Non-demolished footings	Non-demolished footings	Non-demolished footings	Non-demolished footings
7-1	4E to 8E	Conventional (if there is a jetty)	By barge/jetty/floating wharf	Trucks or barges	Site C or D (Brossard) or offsite (transport directly by barge)
7-2	6E to 14E	Standard	By land	Trucks	Site C or D (Brossard)

2.1.3.5.3.1 Standard demolition using a cofferdam

For the footings in water, a cofferdam would be installed around the footing to be demolished. The foundation footing would be demolished using standard demolition and the demolition equipment would be on an nearby barge. The cofferdam therefore serves as containment to make sure that all the demolition debris is physically contained and recovered (Figure 17).

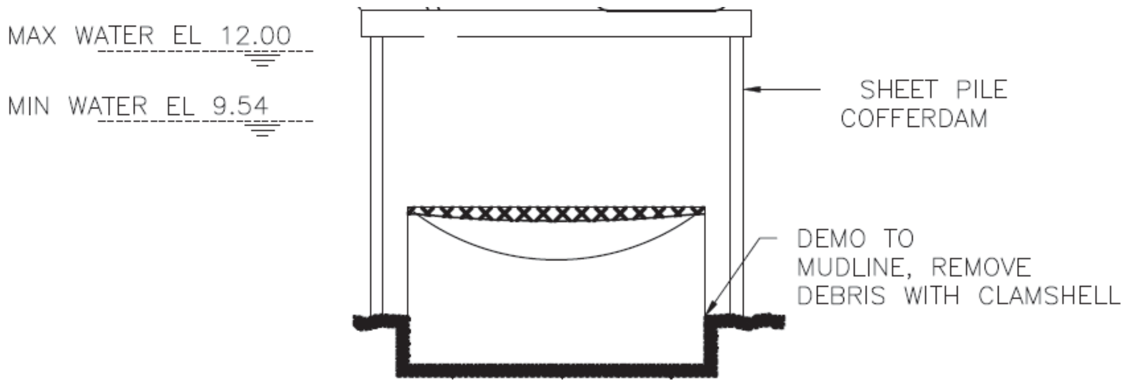


Figure 17 – Cofferdam to be used for footing demolition

2.1.3.6 Summary

Table 11 summarizes the plausible deconstruction scenarios (blue boxes) and possible options (X). Note that although the controlled-explosion method is possible, according to the draft-design study, JCCBI subsequently indicated, when the call for qualification for the deconstruction of the Existing Champlain Bridge was announced in March 2019, that the use of explosives (controlled explosion) was not allowed for the structure and piers (pier caps, pier shafts and footings).

Table 11 – Scenarios - Summary

AREA	CONCRETE DECK			STEEL DECK			PIER CAPS AND PIER SHAFTS		FOOTINGS		
	Standard	Unlaunching	Crane	Reverse erection	Cranes	Hoisting	Standard	Sawing	Standard	Standard with cofferdam	Controlled explosion*
5-1											
5-2											
5-3											
6-1				X							
6-2				X					X (pier 1W)		
6-3				X							
6-4				X							
6-5				X							
7-1	X (in case of a jetty)						X (in case of a jetty)		X (in case of a jetty)		
7-2											

* Possible but not allowed by JCCBI

Note:
Grey box: method not suited to this part of deconstruction
Blue box: viable method
White box: method that is possible but not as suitable
Box with an X: method that is possible but involving certain constraints

2.2 SCOPE OF THE TEA

As the draft design study completed in 2017 showed that various options were available for the deconstruction of the Existing Bridge, JCCBI decided to use an objective-based approach for the TEA.

This approach was used since it is well suited to projects where some details have not yet been defined or will be known at a later time. This is in fact the case for this project, whereas only a concept at the draft-design stage is currently available and the detailed design will be carried out by the contractor selected for the deconstruction (design-build contract).

This approach leads to mitigation measures being drawn up that will become target environmental objectives in the later deconstruction concept development stages, and that will be included in the request for proposals consisting in providing contractors with guidelines for drawing up their concepts. Such an approach thus enables environmental concerns to be integrated ahead of the final project design and thus make it easier to integrate into the environmental components of the host environment. The main project components are presented below and covered in detail in Chapter 6. It is important to note that asset development will be assessed in due course after a reclamation program has been implemented by JCCBI. Asset development refers to the enhancement and development of the vacant spaces resulting from the deconstruction of the Existing Champlain Bridge (see section 9.2 in volume 2 for more details).

2.2.1 PRE-DECONSTRUCTION PHASE

The pre-deconstruction phase includes all the preparatory work required before starting the actual deconstruction. These activities include, without being limited to:

- Work site mobilization and construction of temporary installations
- Maintaining traffic and navigability and installing signage

2.2.2 DECONSTRUCTION PHASE

- Soil stripping and tree clearing
- Excavation and earthworks
- Dismantlement of structures
- Work in an aquatic environment (creation of jetties and pier demolition)
- Management of waste and hazardous materials
- Machinery transport, operation and maintenance
- Temporary closure of the work site, where applicable.

2.2.3 POST-DECONSTRUCTION PHASE

The post-deconstruction phase includes the various activities associated with crew and work site equipment demobilization. These activities include, without being limited to:

- Work in an aquatic environment (removal of jetties);
- Demobilization of the work site and dismantlement of the temporary installations, including site restoration.

2.2.4 OPERATION AND DECOMMISSIONING PHASE

Since the aim of the project is to dismantle the Existing Champlain Bridge, there is no operation or decommissioning phase.

2.3 SCOPE OF ELEMENTS TO BE UPDATED

Special attention was given to components known as “Valued Environment Components” (VEC) chosen based on their scientific, cultural, social, economic or esthetic value. Some components have been updated in relation to the 2013 EA. An updated list of VECs that have been retained for the project is found in Table 12. The updates supplement the data presented in the 2013 EA. The components that were updated are those for which new inventories have been done since 2013, as well as those for which new data were available in the literature or in the databases of the various government departments. One of the objectives was also to see whether the 2013 mitigation measures should be upgraded or revised following changes in the component and additional information on the methods and issues associated with them. More details in this respect are provided below and at the beginning of each section in Chapter 3.

The “Air quality” component is covered through the impacts on traffic, air quality and the sound environment.

Certain VECs could be updated as a result of new data acquired since 2012 on wildlife use at certain times and on certain parts of the land, requests from certain responsible authorities or expert government departments, etc. The updates were done using information in the 2017 PTA study, the 2017 Aecom report (biodiversity study that includes plant and wildlife inventories in the study area of the present project), certain studies and inventories conducted in relation to this mandate, or new inputs. The following VECs were updated:

- Soil quality: compilation of existing data from areas involved by the deconstruction project;
- Water quality: updates based on recent data;
- Sediment quality: analysis in areas close to the piers, where resuspension is possible;
- Bathymetry: survey of missing areas between the Existing Champlain Bridge and the Ice Control Structure in order to improve data precision for hydraulic simulations and obtain more refined data for fish habitats and compensation projects, as well as for jetty construction;
- Ice flow: updates to confirm whether there is a trend related to climate change;
- Air quality: updates based on the precision of possible deconstruction methods and recommendations of stations and parameters for air quality monitoring;
- Flora: updates to status species and invasive alien species (IAS) based on the latest up-to-date lists from the Centre de données sur le patrimoine naturel du Québec (CDPNQ), and aquatic plant communities;
- Wildlife and habitats: inventory during spring bird migrations; updates on occurrences of herpetofauna based on recent 2018 inventories; inventory of aquatic habitats between the bridge and the Ice Control Structure (substrate, velocity, depth, grass beds); benthos inventory; new section on bats; updated status wildlife species;
- Recreation/tourism activities: updates to 2012 data;
- Development projects: updates to 2012 data;
- Navigation: updates to 2012 data;

- Sound environment: simulation for sensitive areas based on details on deconstruction methods and the location of mobilization areas;
- Traffic / mobility: updates to data and project impacts.

Other components such as the administrative framework and land use were also updated.

Table 12 – List of Valued Environment Components selected for the project

ENVIRONMENT	VALUED ENVIRONMENT COMPONENTS	2018-2019 UPDATE
Physical Environment	Meteorological aspects	No
	Topography	No
	Stratigraphy	No
	Soil quality	Yes
	Contaminants on bridge materials	Yes
	Hydrology and hydrogeology	No
	Current measurements	No
	Sediment hydrodynamics	No
	Bathymetry	Yes
	Water quality	Yes
	Ice	Yes
	Air quality	Yes
	Sediment quality	Yes
Biological Environment	Terrestrial vegetation	No
	Aquatic plant communities	Yes
	Status species of flora	Yes
	Invasive alien species (flora)	Yes
	Fish and fish habitat	Yes
	Benthic communities	Yes
	Mammals	No
	Herpetofauna	Yes
	Migratory birds and their habitat (protected areas)	Yes
	Bats	Yes
	Special status species of wildlife	Yes
Human Environment	Administrative framework	No
	Socio-economic profile	No
	Population	No
	Aboriginal communities	Yes
	Land Use	Yes
	Commercial and industrial infrastructures	No
	Residences	No
	Infrastructure	No
	Navigation	Yes
	Recreation/tourism activities	Yes
	Development projects	Yes
	Sound environment	Yes
	Physical and cultural heritage resources (archeology)	No
	Quality of life	No
	Esthetic and visual aspects	No

3 DESCRIPTION OF ENVIRONMENT

3.1 PHYSICAL ENVIRONMENT

3.1.1 SOIL QUALITY

To update the data available at the time of the 2013 EA on the environmental quality of soil and groundwater in the work area, several soil and groundwater environmental characterization studies were consulted and are listed in Appendix 1. The stratigraphy of area soils has not been updated during this process. From the outset, the general description of the stratigraphy as presented in the 2013 EA will likely be similar. A total of 103 sample locations for which chemical analyses were undertaken were considered relevant. These locations are shown on the figures in Appendix 1.

Regarding soil quality, the sample locations were categorized according to the criteria in the Soil Protection and Rehabilitation of Contaminated Sites action guide (*Guide d'intervention*; Beaulieu, 2019) as follows: 30 sample locations in the range ≤ A (background levels); 59 sample locations in the A-B range (between background levels and residential limits); 12 sample locations in the B-C range (between residential and commercial/industrial limits); and two sample locations in the C-RESC range (between commercial/industrial limits and Schedule I of the *Regulation respecting the burial of contaminated soils* – RESC). No sample location indicated levels greater than the standards in Schedule I, RESC. In general, the contamination that was found pertained to one or more of the following parameters: polycyclic aromatic hydrocarbons (PAHs), metals and petroleum hydrocarbons (HP) C_{10} to C_{50}. The detailed results are presented in Appendix 1. The maps in this appendix show the parameters that have exceeded the limits for each sample location.

Regarding groundwater quality, 13 series of analytical results are available for the projected work area. Exceedances of the criteria in By-law CMM2008-47 (municipal criterion for discharge to the sewer system) for manganese were noted in 10 observation wells, whereas an exceedance of the RESIE criterion (provincial criterion for resurgence in surface water) for chlorides was noted. No light immiscible liquids (LIL or free-phase hydrocarbons) were detected or mentioned in the studies that were consulted.

Analyses were done to detect the presence of asbestos in the soil around 30 boreholes. Asbestos was found in one borehole (0.1 to 1%).

Table 13 presents a summary of the results obtained during previous studies. The results are grouped according to the criteria of the soil action guide (*Guide d'intervention*) and the provincial and municipal groundwater criteria. Given the presence of contaminated soils at various levels, a phase II characterization should be done by the chosen contractor before the start of deconstruction work.

Table 13 – Summary of the classification of results of prior soil and groundwater studies

MATRIX	CLASSIFICATION	QUANTITIES
Soils	≤A	30 sample locations out of 103
	Range A-B	59 sample locations out of 103
	Range B-C	12 sample locations out of 103
	Range C– Schedule I, RESC	2 sample locations out of 103
	≥RESC	0 sample location out of 103
Soils	0.1% to 1% asbestos found	1 borehole out of 30
	No asbestos detected	29 boreholes out of 30
Groundwater	>CMM-2008-47	10 wells out of 13
	>RESIE	1 well out of 13
	No criterion exceeded	2 wells out of 13

3.1.2 CONTAMINANTS ON BRIDGE MATERIALS

The potential presence of asbestos and lead in the components of the bridge structure had been briefly covered in the 2013 EA, but without any details being provided. The asbestos studies in 2014 and 2015 (LVM, 2014a,b,c) only involved asbestos present in soil.

This is why in December 2018, a preliminary partial visual inspection of the bridge was done to check for the potential presence of materials containing contaminants or hazardous materials. Following inspections conducted at various locations on the bridge and the interpretation of available data, the presence of materials likely to contain asbestos, silica or lead in the projected work areas was confirmed. The presence of bird droppings on the bridge was also confirmed.

The products or materials containing or potentially containing asbestos, silica or lead are as follows:

- Non-friable materials containing asbestos such as braided products (rebar) under the asphalt and plant mix, membranes and plant mix, products and materials made of fibre cement, sealants (caulking) and various materials making up the expansion and control joints;
- Friable materials as well as surfacing materials considered friable by the Commission des normes, de l'équité de la santé et de la sécurité du travail (CNESST). The above includes, for instance, concrete elements, cement plaster and other concrete repair materials, mortar used to strengthen masonry blocks and textured paint;
- Lead-based coatings: section 6 of the bridge is a steel structure that was frequently stripped and painted. Most of the surfaces that were repainted over the last 20 years were done so using non-lead-based coatings, but touch-ups were done using lead-based coatings. In addition, difficult-to-access elements such as the insides of assembled parts can be painted with original lead-based coatings;
- Components made of concrete, concrete blocks, concrete slabs and other materials that only contain silica.

Based on the preceding, a sampling of materials likely to contain accessible contaminants was done in spring 2019 to determine the presence of asbestos, lead and silica. No sample showed that there was any asbestos in the various surfacing materials as well as in the sealants. However, the asphalt on the spans was not assessed and is likely to contain asbestos. Two positive measurements for the presence of lead in paint were obtained at difficult-to-access locations. Lastly, silica occurs naturally in concrete.

Given these results, worker health and safety risk management measures have been drawn up:

- Asbestos: no OHS risk management measure is required. However, in the event that any asbestos is found in the asphalt, moderate asbestos risk management measures under section 3.23.2.2*d)* of the Safety Code for the Construction Industry (S-2.1, r. 4) will have to be implemented;
- Lead: no OHS risk management measure insofar as workers do not perform any saw or torch cutting of components with lead-based coatings. In the event that workers must carry out this type of work, then the Category 2a management measures in “Guideline: Lead On Construction Projects” (September 2004) will have to be followed;
- Silica: OHS risk management measures are required for the demolition of components containing silica, such as concrete components. Measures for reducing dust at the source, such as water nozzles attached to demolition equipment and the use of snow cannons to create a drizzle in the work area, must be implemented and workers will have to comply with the provisions listed in “Guideline: Silica On Construction Projects” (September 2004);
- Bird droppings: OHS risk management measures are required to clean locations where bird droppings are found on structural elements insofar as workers may disturb them and be exposed to them. The work procedures are outlined in the CNESST document entitled “Des fientes de pigeons dans votre lieu de travail – Méfiez vous!” (DC 100-1331-1 (2011-05)).

3.1.3 BATHYMETRY

A bathymetric survey was conducted in 2012 as part of the EA for the New Bridge. Since then, a few surveys have been done in the area, in particular in 2015 and 2018, but only in some parts. The data analysis shows that a section of the Greater La Prairie Basin between the Existing Champlain Bridge and the Ice Control Structure was not covered. Therefore, an update and additional information were required in this area.

Several bathymetric surveys were conducted in the St. Lawrence at Montreal, with nine bathymetric surveys carried out near the bridge between 1984 and 2018. The available datasets are not homogeneous in terms of the methodology used and data quality.

There are conventional bathymetric surveys conducted using a single-beam echo sounder and surveys performed with LiDAR technology. In addition, there is a lack of bathymetric information in a narrow strip immediately upstream of the Existing Champlain Bridge 200 m long and 1,780 m wide. Surveys were conducted on this area in spring 2019. The results are shown on Map 3.

3.1.4 ICE

An analysis of the ice flow was done in 2013 as part of the EA for the New Bridge. An update of this assessment based on the most recent ice data is required to describe the current ice flow as well as the effect of climate change on the winter conditions that were observed.

In the context of the deconstruction of the Champlain Bridge, it is important to adequately characterize the ice flow given that temporary jetties will be installed in the St. Lawrence for two or three consecutive winters. The jetties must therefore be designed based on the ice conditions expected at that location.

3.1.4.1 Data used

The analysis of the ice flow around the Existing Champlain Bridge is based on ice observation charts produced by the Canadian Ice Service (CIS). The charts that were consulted are those of the South Shore Canal (WIS83) covering the section between the Lake Saint-Louis outlet to the Old Port of Montreal. The data that were consulted extend from December 2004 to March 2018 (14 consecutive winters). A total of 190 ice charts were retrieved and used for the analysis, i.e. an average of 13 charts per annual observation period. The analysis of the period of 2013-2018 supplements the 2013 EA by revealing the effect of climate changes on recent winters.

For the 190 ice charts that were consulted, all of the information they contain corresponding to the formation of ice in the Champlain area, both in the St. Lawrence and in the Seaway, were extracted and compiled into a database.

3.1.4.2 Canadian Ice Service charts

The thematic charts provided by the CIS schematically represent the ice conditions observed at a given time, which were made by Canadian Coast Guard (CCG) personnel when icebreakers passed through or helicopters flew over the area. It is important to point out that the frequency of the observations is highly variable. At some times, series of charts are produced daily, while at other times during the winter, several weeks may go by without any new charts being produced. Hence, as the temporal analyses presented in the following sections depend on the frequency at which the charts were produced, they are not precise as to the duration of the phenomena being described.

Ponts JACQUES CARTIER + CHAMPLAIN Bridges

2019 Bathymetric Data

Depth (m)

- 0 - 2
- 2 - 5
- 5 - 15
- 15 and more

DECONSTRUCTION OF ORIGINAL CHAMPLAIN BRIDGE (2017-2022)
CONTRACT No. 62555
MONTREAL, QUEBEC

2019 Bathymetric Survey

March 2019

Coordinate system: NAD83 MTM 8

Base map: Google 2018

Parsons Tetra Tech Amec Foster Wheeler

Map 3

\\TTS350FS2\prj_reg\36118TT\DOC-PROJ\60\60CRO\ArcGIS_ArcMap\36118TT_Map3_2019BathymetricData_20190729.mxd

3.1.4.2.1 Egg Code

The CIS uses the Egg Code to indicate observations of ice with respect to concentration, stage of development, and floe size (any relatively flat piece of ice 20 m or more across). Figure 18 shows the diagram used to describe ice on all charts, in accordance with international convention.

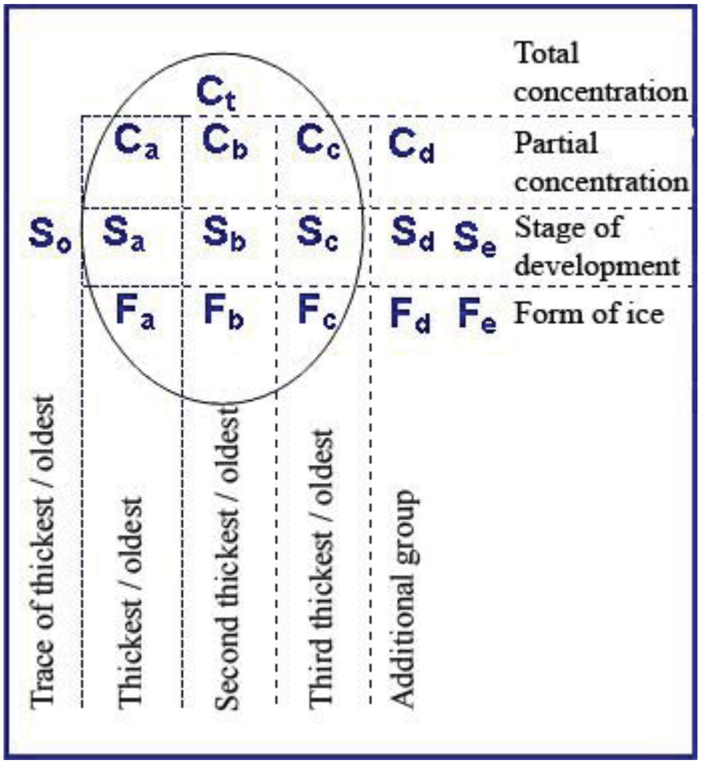


Figure 18 –Egg Code diagram

3.1.4.2.2 CIS colour code

In addition to the Egg Code, CIS charts use a colour code to describe the concentration of ice based on thickness, the presence of pack ice, or the absence of ice in open water. This colour code is in fact used in this analysis to estimate the percentage of pack ice (static ice cover) to the right of the Existing Champlain Bridge. Figure 19 shows an example of an ice chart (February 27, 2006).

In this example, the pack ice marked by the grey areas occupies about 20% of the St. Lawrence's flow width to the right of the bridge and 100% of the width of the Seaway. It can be noted that virtually all of the St. Lawrence is covered in white with blue asterisks indicating a predominance of ice less than 10 cm thick. Lastly, the section to the right of the bridge is occupied by zone E. The Egg Code associated with zone E shows the concentration, stage of development and size of the drift ice moving through this area.

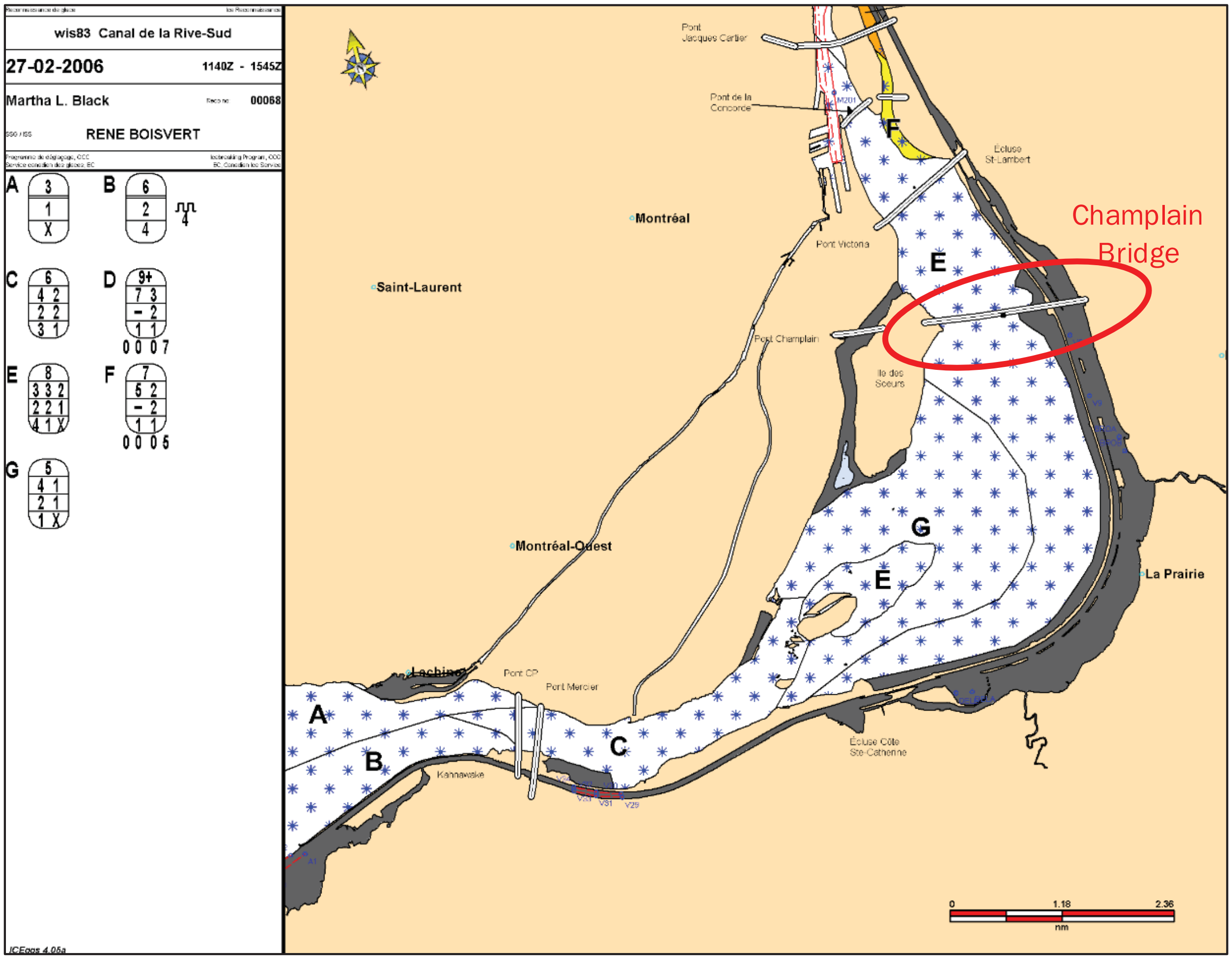


Figure 19 – Ice chart of February 27, 2006 (CIS, 2006)

3.1.4.3 Data analysis

The Existing Champlain Bridge crosses both the St. Lawrence and the Seaway (located on the south shore). A preliminary analysis of the ice charts revealed that these two channels have separate glaciological features. The analyses presented in this section were thus made separately for each one and then compared between them.

3.1.4.3.1 Duration of ice season

Trends in the duration of the ice season, presented in Figure 20, were analyzed to determine the number of days during which ice can be potentially observed to the right of the Champlain Bridge. An ice season is defined as the duration between the first observation and the last observation of ice on CIS charts, regardless of the type of ice. The season may thus begin with the appearance of a cover of static ice (pack ice) or a small concentration of drift ice. It then ends after any remaining drift ice has passed through, or after the last pieces of pack ice near the bridge are gone.

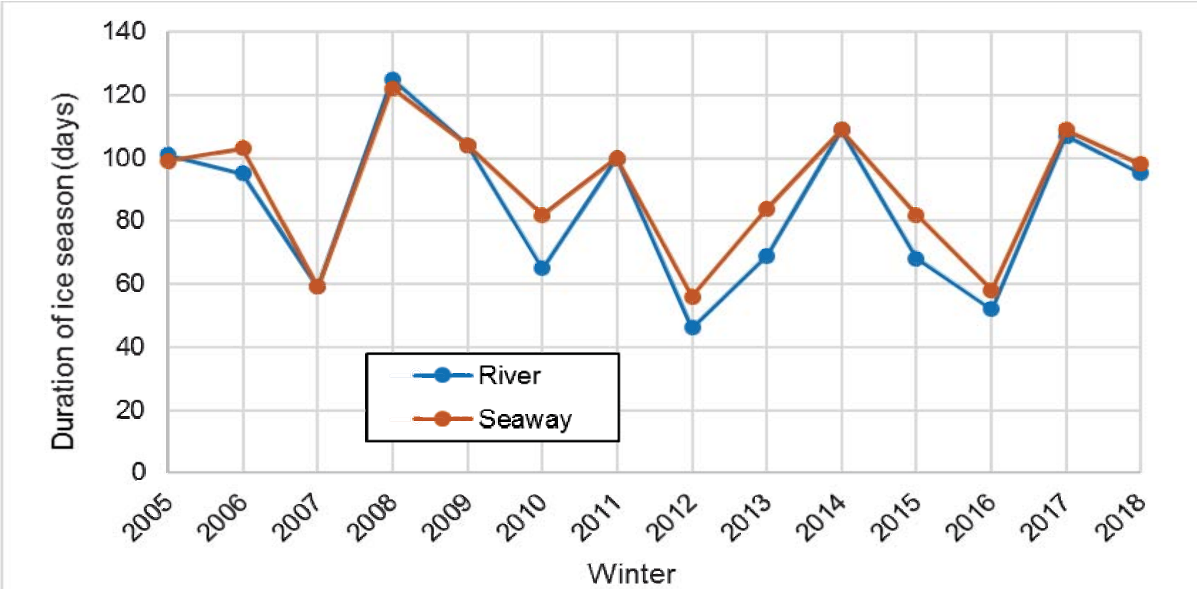


Figure 20 – Duration of ice season (2005 to 2018)

In general, the ice season is longer in the Seaway than the St. Lawrence, mainly because of the static ice cover formed in the Seaway at the start of the season, which becomes thicker over the course of winter and remains in place until it melts. This ice cover formation process is observed because of the low flow velocities in the Seaway.

Given the number of sampling years and the shape of the curves (Figure 20), no clear long-term trends can be determined as to the duration of the season. However, it is possible to note the cyclical nature of the maximum and minimum durations that were observed. In fact, the long-duration seasons have a three-year return period while the short seasons have a return period ranging from two to four years.

3.1.4.3.2 Formation of static ice cover (pack ice)

The ice in pack ice, defined as ice that forms and remains stationary where it is attached, was analyzed from the standpoint of its total coverage of the channel as well as the time when it was formed and melted (or broke away). Figure 21 and Figure 22 show the annual trends in these parameters, to the right of the Champlain Bridge, for sections of the St. Lawrence and the Seaway, respectively.

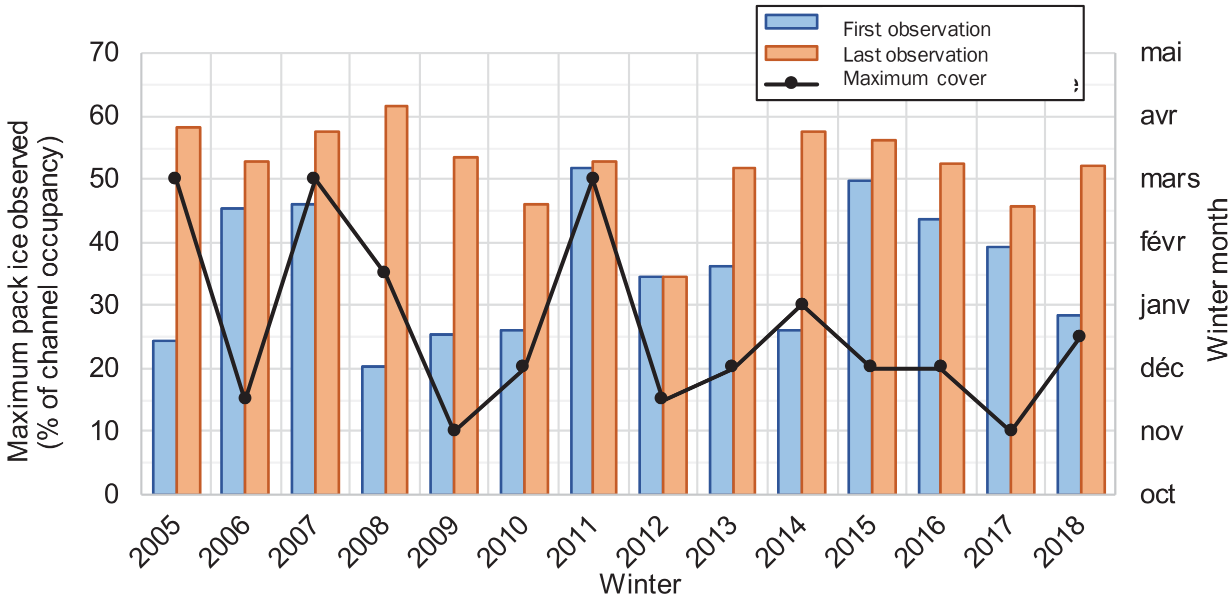


Figure 21 – Coverage and duration of pack ice in the St. Lawrence (2005 to 2018) – Date of observations on the right axis

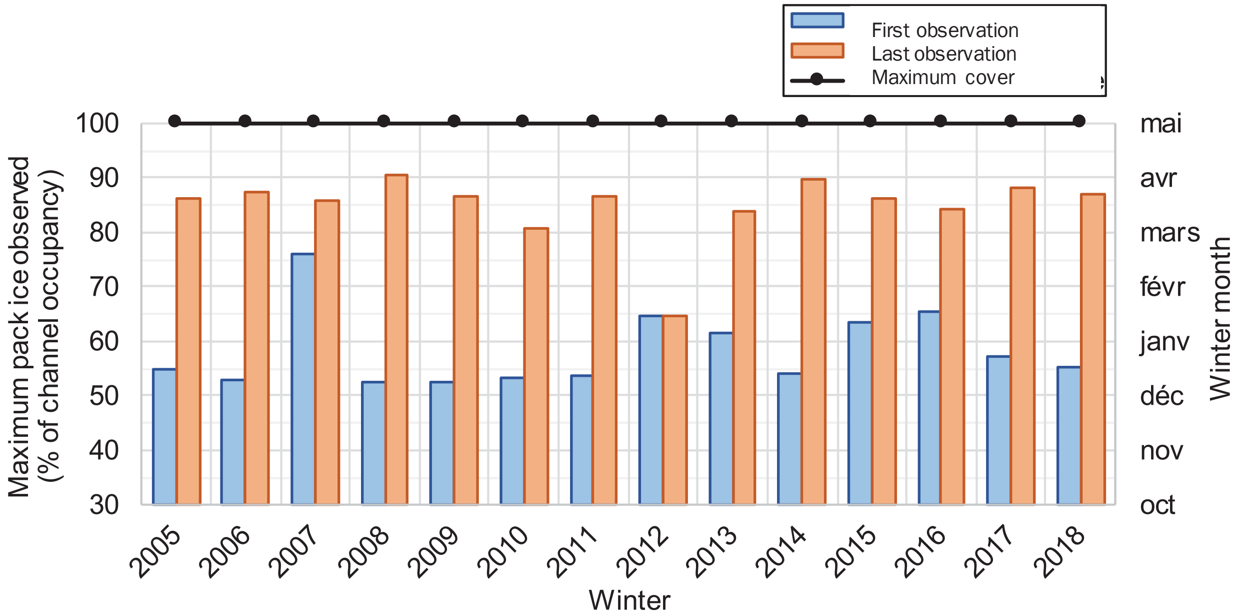


Figure 22 – Coverage and duration of pack ice in the Seaway (2005 to 2018) – Date of observations on the right axis

It is important to note that the percentage of channel occupancy by pack ice to the right of the Existing Champlain Bridge was estimated visually using CIS ice charts. In fact, this type of ice is only shown schematically on the charts.

The static ice cover on the St. Lawrence is generally formed on the right shore (on the Brossard side) (Figure 19) and extends to the left shore (Nuns' Island side) to cover up to 50% of the channel width. This percentage of cover was observed three times (in 2005, 2007 and 2011). For all the winters that were analyzed, pack ice occupied at least 10% of the width of the St. Lawrence to the right of the bridge (2009 and 2017). Two phenomena could account for the formation of pack ice at that location:

- The presence of the Ice Control Structure 300 m upstream of the bridge;
- The direction of prevailing westerly winds that favour the accumulation of ice on the right shore.

With spacing of about 25 m between its piers, the Ice Control Structure upstream of the Champlain Bridge generally favours the formation of an ice cover that retains moving floes, and limits the risk of ice jams, thus ensuring the safe operation of vessels up to the Port of Montreal. In addition, during the spring breakup period, the Ice Control Structure handles thicker and larger pieces of drifting ice by preventing them from accumulating further downstream in the port area. However, the local effect of the Ice Control Structure was not covered in the analysis.

The times of the first and last observation of pack ice on the St. Lawrence vary significantly depending on the winter. In fact, during the 2008 season, i.e. the longest season reported for the years that were analyzed (Figure 20), the formation of the static ice cover began in early December and lasted until early April. Conversely, in the winter of 2012, i.e. the shortest ice season that was analyzed (Figure 20), pack ice only formed for a few days in January. A similar phenomenon was observed in the winter of 2011 when pack ice was only observed in the first half of March.

Contrary to the pack ice observed in the St. Lawrence, there is very little annual variability in the Seaway pack ice in terms of both percentage of ice cover and times of formation and breakup. Note that for each winter that was analyzed, pack ice occupies the entire flow width to the right of the Existing Champlain Bridge. In general, CIS ice charts show that formation begins in December but may occasionally start in January. The latest first observation was in February 2007. Breakup of the pack ice occurred in March for all the winters, except on two occasions, i.e. winters of 2008 and 2012, when the breakup was observed in April and January. Note that these two winters respectively correspond to the longest and shortest ice seasons (Figure 20) in the sample that was analyzed.

The marked presence of pack ice as a dominant ice phenomenon on the Seaway is mainly explained by slow-moving currents. In fact, being controlled by a system of locks located about 3.2 km downstream of the Existing Champlain Bridge, current speeds promote the formation of a static ice cover created from the shore and progressively extending toward the middle of the channel, until completely covered.

3.1.4.3.3 Characteristics of moving ice

The characteristics of moving ice have also been analyzed to define their concentration, stage of development and form. Figure 23 first shows the total concentration of ice flowing on the St. Lawrence River and Seaway. This concentration corresponds to the coverage by drifting ice of the free water surface not taken up by pack ice. Note that the production frequency of the ice charts is highly variable, ranging from one day to a few weeks. The time series presented in Figure 23 must therefore be only considered as indicative of the conditions observed.

The total concentration graphs for the winters of 2005 to 2018 (Figure 23) first show that the maximum concentration of moving ice during the winter is at least 80% each year. Depending on the periods of intense cold or thaw, the concentration can significantly vary over a short period. Although maximum ice concentrations are typically observed early in the season at freeze-up, concentrations of 80 to 90% are frequently found in the winter. The lack of pack ice covering the entire surface of the St. Lawrence, combined with the significant concentration of moving ice throughout the winter, makes the Existing Champlain Bridge area highly dynamic from a glaciological perspective.

Like the St. Lawrence, the maximum concentration of moving ice on the Seaway during the winter was at least 80% for all years, with the exception of 2016 when the concentration remained at 0%. This is explained by the fact that as soon as the first ice chart is produced, the pack ice was covering the entire width of the Seaway to the right of the Existing Champlain Bridge. Therefore, no moving ice was observed at the time. Concentrations of 0% (full pack ice) are in fact reported for the 14 years that were analyzed.

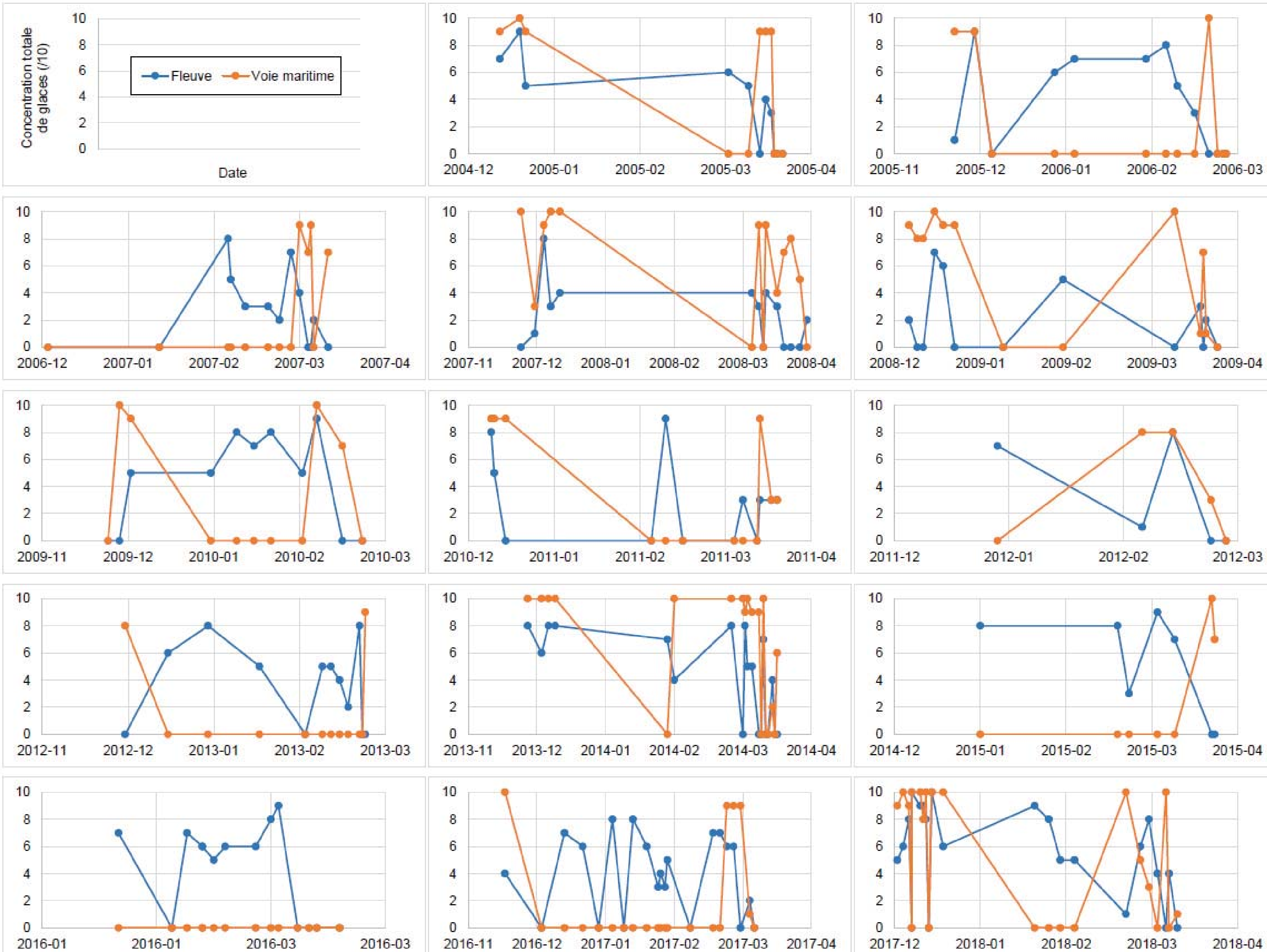


Figure 23 – Changes in total concentration of moving ice - winters of 2005 to 2018

The maximum development stages observed for each winter period (2005-2018) are presented in Figure 23. In general, moving ice around the Champlain Bridge, for both the St. Lawrence and the Seaway, reaches the stage of thin first-year ice (30-70 cm in thickness). For 2016, the only type of ice observed in the Seaway was pack ice.

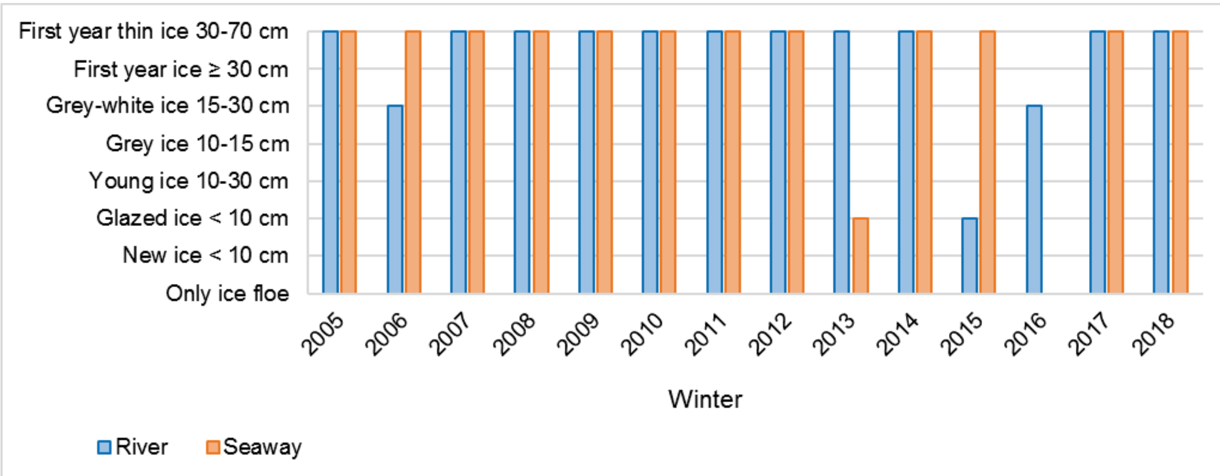


Figure 24 – Maximum ice development stages (thickness) (2005 to 2018)

As for the maximum size of drifting ice (Figure 25), it can be generally noted that the ice floes in the St. Lawrence are of equal or greater size than those in the Seaway. Maximum annual sizes of 100-500 m were observed in both channels. For 2006 and 2016, CIS ice charts indicate that the size of the pieces of ice in the Seaway was limited to pancake ice (rather circular pieces up to 10 cm in thickness) given the fast formation of pack ice (static ice cover), the dominant ice process during these two winters.

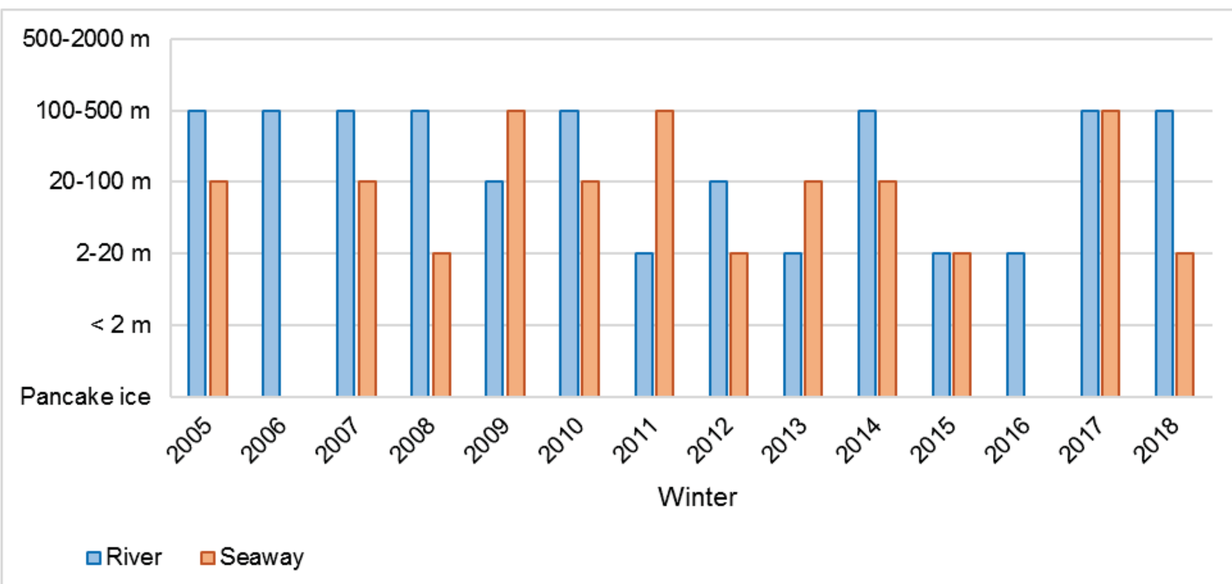


Figure 25 – Maximum ice floe size (2005 to 2018)

3.1.4.3.4 Analysis summary

Table 14 presents a summary of the various observations drawn from the CIS ice charts.

Table 14 – Summary of observations

CHARACTERISTIC	ST. LAWRENCE	SEAWAY
Duration of ice season (days)	46 to 125	56 to 122
Maximum pack ice cover (%)	10 to 50	100
Pack ice observation period	December to April	December to April
Ice floe active period	December to March	December and March
Maximum ice floe thickness (m)	0.70	0.70
Maximum ice floe size (m)	100-500	100-500

It is important to note that all the results discussed were obtained from the CIS ice chart analysis. No measurements of *in situ* ice thickness or floe size were done for this study.

3.1.4.4 Influence of climate changes

All of the analyses presented in the previous section lead to the conclusion that the ice regime in the Existing Champlain Bridge area is significantly affected by climate changes. In fact, the extent of the static ice cover (pack ice) on the St. Lawrence (Figure 21) appears to progressively decrease with a more marked trend since the winter of 2012. The duration of this pack ice also appears to progressively decrease, in both the St. Lawrence and the Seaway (Figure 22). Note that the first observations of pack ice tend to occur later, especially since the winter of 2012.

The thickness (Figure 23) and size (Figure 25) of the ice floes also seem to follow trends representing an increase in average temperatures. In fact, the occurrence of winters where ice floes are not very thick and limited in size appears to be more frequent in the past years. For two consecutive winters (2015 and 2016), the thickness of ice floes in the St. Lawrence did not exceed 30 cm, which had not been seen since 2006. With respect to size, the ice observed in 2011, 2013, 2015 and 2016 did not exceed 20 m, which had not been reported between 2005 and 2010.

However, the ice season duration graph (Figure 20) does not enable a clear temporal trend regarding the influence of climate changes to be established given that the duration is from the first and last ice observation (static or moving ice). However, despite the increase in average temperatures, ice can still be observed in early fall or later in the spring.

Lastly, note that the winter of 2018-2019 appears relatively harsh. The first ice chart was produced on December 11, 2018, which will not allow the ice season to be properly assessed. However, on February 26, 2019, the pack ice on the St. Lawrence had a cover of about 60% starting from the right shore. Comparatively, such a cover had not been observed from 2005 to 2018.

3.1.5 SURFACE WATER QUALITY

In Section 4.1.5 of the EA, Dessau-CIMA+ (2013) presents historical data on surface water quality at sampling stations located in the Champlain Bridge area. The data were obtained from sampling carried out between 1980 and 2010 at stations located in the St. Lawrence River in the Montreal area. There is no station near the bridge. In fact, most of the stations are located upstream and some downstream of the bridge. Dessau-CIMA+ has concluded that no parameters measured for these studies exceeds the water quality criteria for the protection of aquatic life.

In 2016, Aecom (2017) took physicochemical measurements from May to July at a few stations in the Existing Champlain Bridge area. The physicochemical parameters measured in the study area are presented in Table 15.

Table 15 – Physicochemical characteristics of the water near the Champlain Bridge (adapted from Aecom, 2017)

LOCATION	DATE	TEMPERATURE (°C)	DISSOLVED OXYGEN (MG/L)	OXYGEN SATURATION (%)	PH	CONDUCTIVITY (µS/CM)	TURBIDITY (UTN)
Nuns' Island channel	2016-06-03	18.3	11.16	117.1	8.87	215.3	4.11
North of Nuns' Island	2016-07-28	24.1	9.15	108.8	7.76	264	--
East of the Bonaventure Expressway	2016-06-03	18.3	10.3	109.4	8.91	216.3	4.55
East shore of the Greater La Prairie Basin	2016-05-25	16.9	13.24	138.1	9.13	252.6	2.74
Greater La Prairie Basin	2016-07-28	23.5	9.49	111.8	8.06	324	--
Lesser La Prairie Basin	2016-05-25	14.4	12.56	122.3	8.92	239.2	1.55
West shore of the Lesser La Prairie Basin	2016-07-29	23.4	8.7	102.4	8.2	232	--
Seaway	2016-07-29	23.5	8.94	105.2	8.19	329	--

Source: (Excerpted from Aecom, 2017).

All the parameters measured by Aecom in 2016 (Aecom, 2017) complied with the aquatic life criteria of the Ministère de l'Environnement et de la Lutte contre les changements climatiques (MELCC) and the Canadian Council of Ministers of the Environment (CCME).

The most recent data obtained from the MELCC sampling station in LaSalle (11 km upstream of the Champlain Bridge) cover the period from May 2015 to October 2017 (MELCC, 2019). The bacteriological and physicochemical water quality indices (IQBP6) calculated for this period range from 82 to 94 (raw data presented in Appendix 2), which represents good quality water for general use, including swimming.

As with the data presented in Dessau-CIMA+ (2013), recent data are similar to historical data and also comply with water quality criteria for the protection of aquatic life.

3.1.6 SEDIMENT QUALITY

When the 2013 EA was being carried out (Dessau-CIMA+, 2013), a sediment sampling campaign was started in the footprint of the New Bridge to determine the physico-chemical quality of the substrate in the Lesser and Greater La Prairie basins. Several samples were collected in the Lesser La Prairie Basin. However, because of the rocky substrate, only one sample could be collected in the Nuns' Island section and none in the Greater La Prairie Basin (Dessau-Cima+, 2013). To date, sediment quality has been well documented in the Lesser La Prairie Basin area, i.e. under sections 6 and 7 of the Existing Champlain Bridge. This area was sampled during the historical studies (Hardy *et al.*, 1991) and during the 2013 EA (Dessau-Cima+, 2013). Almost no sediment characterizations were done in the Greater La Prairie Basin (section 5) during these previous studies.

Therefore, the aim of the 2018 campaign carried out by PTA for this project was to supplement the data in the areas that were not covered, with this component used to draw up the general state of the aquatic habitat in the study area. In addition, in terms of receptors, there is the water intake for the Saint-Lambert water filtration plant located about 3 km downstream of the bridge. A campaign should therefore extend to section 5 with emphasis on the Nuns' Island shoreline around the piers.

3.1.6.1 Additional survey in 2018

This section presents a summary of the methodology, the sampling campaign results, and a comparison of the results with those of previous campaigns. A full description of the methodology is provided in Appendix 3.

3.1.6.1.1 Methodology

According to the proposed deconstruction method, only the sediment surface would be potentially disturbed. The sediment sampling stations were therefore placed to coincide with the benthos sampling stations (Map 6). The collection of four samples in the Greater La Prairie Basin, including the Nuns' Island shoreline, along with duplicate surface sediments by fording or using divers, was planned to verify the environmental quality of the sediments and assess the impact of their potential resuspension during the work. According to the latest St. Lawrence Action Plan guide (EC and MDDELCC, 2015), and based on the project receiving environment, these assessments comprise the clastic portion of the aqueous part. When there is a risk of human interrelation with the sediment, it is recommended to take into account the pore water (interstitial water).

3.1.6.1.1.1 Analysis criteria

The criteria used for assessing sediment quality in Quebec (EC and MDDEP, 2007) are based on the approach retained by the Canadian Council of Ministers of the Environment (CCME, 2014) in order to meet sediment management needs in various contexts specific to Quebec.

Two reference values were retained here from among the sediment quality criteria (EC and MDDEP, 2007) in a scenario of sediment resuspension: the Threshold Effect Level and the Probable Effect Level (PEL). The other criteria are presented for reference purposes, but are mainly used for sediment management in dredging situations. Natural levels correspond to the levels measured in pre-industrial sediments (<1920) that had not been modified in any way or subject to any chemical alteration from a human source. Ambient levels characterize sediment concentrations across a region, in this case Lake Saint-Louis.

The criteria for the assessment of pore water quality are based on those used for surface water (CCME, 2014).

3.1.6.1.2 Results

A compilation of the chemical analyses conducted on sediment samples is found in Appendix 3 (Tables 1 and 2). A colour in the compilation table indicates that the criterion was exceeded. Because of the strong current, no grain size or sediment quality surveys could be done at station BS-03.

3.1.6.1.2.1 Grain size

Three stations (BS-01, BS-02 and BS-04) were sampled during the campaign. The Nuns' Island shoreline is covered with surface stones not very suitable to the accumulation of sediment.

Analyses show that the sediments at stations BS-01 and BS-04 are made up of a coarse fraction dominated by gravel. Station BS-02, located under the Existing Bridge, shows that silt and sand are dominant. Overall, clay constitutes 2 to 3 % of the sample mass.

3.1.6.1.2.2 Sediment quality

The compilation of the chemical analyses (Table 1 in Appendix 3) shows that the sediments at the stations along the Nuns' Island shoreline (BS-01 and BS-02) (Map 6) present some contamination, since several values exceed the NOL criterion. However, in the case of four metals, the natural concentrations of postglacial clay have higher values. In the case of chromium, the levels observed are lower than those in pre-industrial sediment. When compared to the ambient levels found in Lake Saint-Louis, most of the samples have a lower value. In this respect, zinc is the only metal that slightly exceeds the unexplained NOL.

Regarding PAHs, virtually half of the 27 parameters analyzed show an exceedance of the NOL for stations BS-01 and BS-02. C_{10}-C_{50} hydrocarbons are also detected in one sample and in the duplicate sample (BS-02), which confirms that motor oil is responsible for the presence of PAHs. Note that there are no criteria for this parameter in sediment. Given the synthesis of knowledge on sediment quality in the Greater and Lesser La Prairie basins by Fortin *et al*. (1997), the survey included an analysis of polychlorinated biphenyls (PCBs) and chlorobenzenes to take into account a known issue. The results show that the study area appears to be free of these contaminants, since the values are below laboratory detection limits.

In summary, deepwater station BS-04 showed better quality than the shoreline stations. With the exception of arsenic, no NOL exceedances were observed. At that location, grain size consists of little fine material, whereas organic matter, assessed through the percentage of total organic carbon, is virtually absent, since the values are below laboratory detection limits. Sediment containing little fine material and organic matter does not tend to adsorb contaminants.

3.1.6.1.2.3 Pore water

The sediment survey only resulted in the collection of a small quantity of pore water. Because of the method used, the deepwater stations were automatically excluded since the collection of the sample by divers in the middle of flowing water could not guarantee its integrity.

The results of the quality of the pore water samples did not show any exceedances of the short- or long-term criterion (Table 2 in Appendix 3).

3.1.6.2 Synthesis of knowledge – Chemical quality of sediment

Figure 26 shows the location of historical sediment sampling. The areas circled in black represent the stations that were sampled for the 2013 EA (Dessau-Cima+, 2013).

The sampling campaigns from 1976, 1987 and 2012 show a history of heavy metals and PCBs in the Lesser La Prairie Basin (Table 16). This table shows the parameters that were monitored during the various studies. The other parameters analyzed during the 2018 campaign are presented in Tables 1 and 2 in Appendix 3, as mentioned above.

Although the results from 2012 continued to exceed regulatory thresholds, they indicated a reduction in contaminant levels compared to those from previous analyses. More recently, a few sediment surveys from 2018 enabled the above knowledge to be extended to the Greater La Prairie Basin. The levels observed in this major river area show a level of contamination below the Occasional Effect Level (OEL) for both the Nuns' Island shoreline and deeper waters.

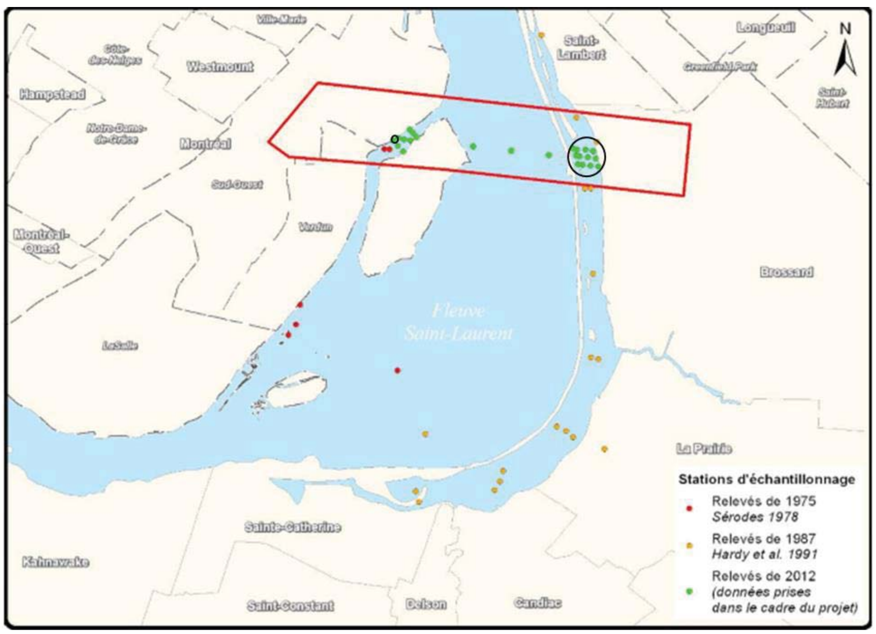


Figure 26 – Historical sampling of sediment in the St. Lawrence River in the Champlain Bridge area (Dessau|Cima+, 2013)

Table 16 – Results of sampling from 1976 to 2018 compared to current criteria (Greater La Prairie Basin, Lesser La Prairie Basin and Nuns' Island section)

PARAMETER	SERODES 1978 (N=17) GREATER BASIN AND NUNS' ISLAND[1]	HARDY *ET AL.*, 1991 (N=18) LESSER BASIN AND GREATER BASIN[2]	DESSAU-CIMA+, 2013 (N=12) LESSER BASIN	2018[3] (N=2) NUNS' ISLAND SHORELINE	DESSAU-CIMA+, 2013; EXP, 2013*; 2018[3] (N=4) GREATER BASIN	MDDEFP AND ENVIRONMENT CANADA CRITERIA (MG/KG)				
	MEDIAN (MG/KG)	MEDIAN (MG/KG)	MEDIAN (MG/KG)	MEDIAN (MG/KG)	MEDIAN (MG/KG)	≤OEL	OEL	>OEL AND ≤FEL	FEL	>FEL
Mercury	0.46	0.34	0.21	0.12	0.16	Class 1	0.25	Class 2	0.87	Class 3
Arsenic	---	9.82	5	4.6	5.9		7.6		23	
Cadmium	9	1	1.15	0.1	0.38		1.7		12	
Chromium	73	105	49	35	20		57		120	
Copper	55.3	62.9	57.50	38	26.5		63		700	
Nickel	48.4	41.1	41.00	35.4	29.0		47		–	
Lead	48	137	98.5	28	21.5		52		150	
Zinc	315	392	270	143	101		170		770	
PCBs (total)	---	0.651	0.19	<0.01	<0.01		0.079		0.78	

[1] The six stations in the Greater La Prairie Basin and the Nuns' Island section come from Environment Canada data (see Figure 26). The locations of the other stations along the river between Cornwall and Montmagny are not mapped.
[2] Total of 17 stations in the Lesser La Prairie Basin and 1 in the Greater La Prairie Basin (see Figure 26).
[3] 2018 campaign conducted by PTA for this project

Regarding other sediment quality parameters, a sample collected by EXP (2013) during drilling around pier 4W showed an exceedance of the soil "A" criterion for five PAH compounds. The determination is similar for the two samples from the Nuns' Island shoreline which have four PAH compounds above the OEL (acenaphtene, benzo(a)anthracene, phenanthrene and pyrene). As previously indicated, C_{10}-C_{50} petroleum hydrocarbons were detected during the 2018 campaign (PTA). However, when analyzed, the various prior campaigns had not detected any C_{10}-C_{50} petroleum hydrocarbons, phenols or chlorobenzenes. The complete list of all the parameters that were analyzed is found in Appendix 3.

3.1.7 AIR QUALITY

The quality of the air currently found in the Existing Champlain Bridge deconstruction project area should be representative of the air quality of a large city, and the periodic exceedances of some of the above-mentioned parameters are not considered unusual:

- Particles (particulate matter - PM);
- Particles under 2.5 microns ($PM_{2.5}$);
- Nitrogen oxides (NO_x);
- Ozone (O_3);
- Carbon monoxide (CO).

The ambient air quality depends on the current sources of emission in the project area. The following sections present an overview of the sources of emission not related to the site and with an emission profile similar to that of emissions generated by deconstruction activities. These emissions unrelated to the site could potentially affect the concentrations recorded at the air quality sampling stations, resulting in the limit being exceeded, which would not have been caused solely by deconstruction activities. Regional events that affect air quality such as smog can also result in the limit being exceeded.

Ambient levels around the project site and before the start of construction of the New Champlain Bridge, which are presented further on, were generally considered good compared to air quality criteria.

3.1.7.1 Sources not related to the site

There are many manufacturing companies in the south-western part of the Island of Montreal, near the Lachine Canal and the Old Port of Montreal, within a 5-km radius centered on the New Champlain Bridge. This 5-km area was chosen to include the receptors on both shores of the St. Lawrence and the nearby manufacturing plants. Furthermore, considering the contaminant characteristics as well as the meteorological and topographic conditions that affect contaminant dispersion, this radius enables the project impacts to be assessed in relation to pre-work ambient conditions (Hu, Fruin *et al.,* 2009).

Several plants are found in Griffintown and Verdun near the Champlain Bridge (Figure 27). Data on airborne emissions reported to ECCC's National Pollutant Release Inventory (NPRI) are used to characterize the emissions (in tonnes) usually generated each year by some of the manufacturing plants in this area.

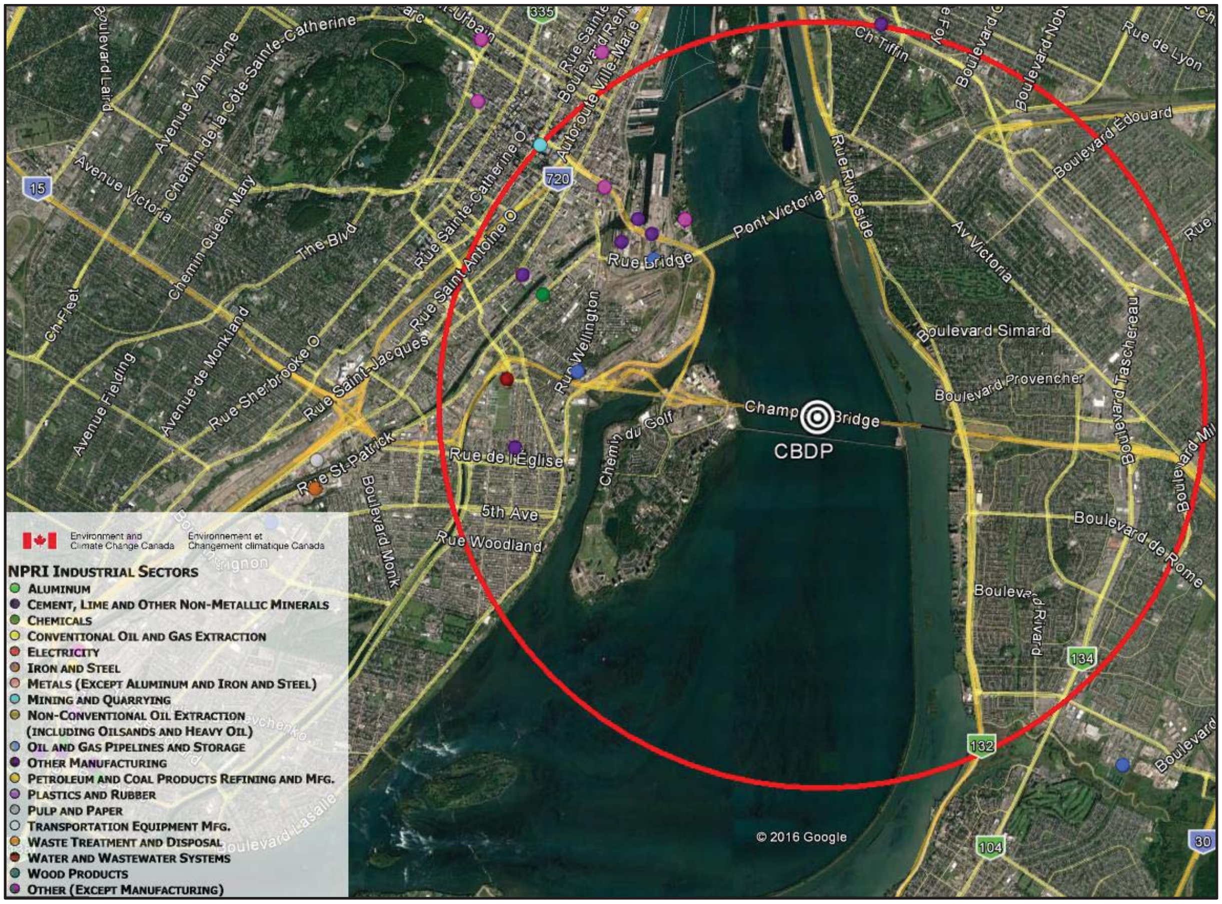


Figure 27 – Facilities reporting data to the NPRI within a 5-km radius from the project

Table 17 presents information from NPRI data for 2014, the most recent year with available recorded data.

The Existing Champlain Bridge is located in an area that is also affected by anthropogenic sources of atmospheric emissions from the City of Montreal, as the bridge is connected to Nuns' Island to the east and Brossard to the west. Since Nuns' Island and Brossard have respective populations of 18,315 (2011) and 85,721 (2016), these two communities can generate significant emissions affecting the project area through residential heating, vehicle driving and property maintenance. Furthermore, the Existing Champlain Bridge is one of the busiest bridges in Canada, with 40 to 60 million vehicles crossing it per year, according to estimates.

The area has also seen a lot of construction in the last three years. Construction on the New Bridge should be completely finished when the deconstruction project begins.

Table 17 – Summary of NPRI data reported in 2014 for plants near the Champlain Bridge on the Island of Montreal

COMPANY	ANNUAL ATMOSPHERIC EMISSIONS (IN TONNES)						
	PM_{10}[1]	$PM_{2.5}$1	PM	NO_2[2]	SO_2[3]	VOC[4]	CO
A	36.8	31.53	40.49	386.39	284.97	19.77	88.8
B	9.7	4.0	--	--	--	--	--
C	0.97	0.87	--	73.49	4.93	--	29.76
D	3.09	2.53	--	--	--	--	--
E	14.45	6.03	54.28	--	--	--	--
F	41.306	20.617	41.785	--	--	--	--
G	1.614	0.272	6.374	0.514	--	0.04	0.431
H	1.1	0.914	--	--	--	--	--
I	0.782	0.787	6.84	68.5	--	--	--

1. PM_{10}: Particles under 10 microns
2 NO_2: Nitrogen dioxide
3. SO_2: Sulphur dioxide
4. VOC: Volatile organic compound

On Nuns' Island and in Brossard, construction of the Réseau express métropolitain (REM) will take place at the same time as deconstruction work. Based on available reports, it appears that the current bus terminal on Panama street and Taschereau boulevard will be torn down and a new bus terminal will be built at the same location. The current bus terminal is located about 2 km west of the Existing Champlain Bridge. A REM station will be built along Highway 10 on Nuns' Island about 50 m west of the project area. The station will be close to the location where deconstruction work will be done and the project mobilization areas. It is likely that new rail tracks will be installed for the REM project, though it is unknown how close these tracks will be to the project area.

3.1.7.2 Baseline data on air quality before the construction of the New Champlain Bridge

As part of the 2013 EA, INFC agreed to implement an air quality monitoring program during construction of the New Bridge. In June 2014, a sampling station (Nuns' Island station 1) was set up about 30 m from the Existing Champlain Bridge toll booth on Nuns' Island to measure air quality before the start of construction of the New Bridge in 2015.

This station was set up between lanes of opposite-direction traffic, which provides results for what should be the worst-case scenario (Figure 28). This sampling station continuously measured nitrogen oxides (NO), NO_2, NO_x, O_3, SO_2, $PM_{2.5}$ and total particulate matter (PM_{tot}). Volatile organic compounds (VOCs) were measured by the National Air Pollution Surveillance (NAPS) Network.

Figure 28 – Air Quality Monitoring Stations of National Air Pollution Surveillance (NAPS) Network

In September 2014, ECCC published a preliminary report entitled "New bridge for the St. Lawrence: Air quality assessment in the new bridge for the St. Lawrence corridor" (Environment Canada, 2014) that presents an overview of the baseline-condition results for the Nuns' Island 1 sampling station (MAQRU for ECCC), as well as a comparison of these measurements with data from the other three stations on the Island of Montreal (Verdun) and the South Shore (Longueuil and Brossard). Table 18 provides information on each station. The location of the stations is shown on Figure 28.

Table 18 – ECCC's NAPS/air quality monitoring stations near Champlain Bridge

NAME OF SAMPLING STATION	LOCATION	LATITUDE (N)	LONGITUDE (W)	APPROXIMATE DISTANCE FROM THE SITE (IN KM)	PARAMETERS MONITORED
Nuns' Island 1 (MAQRU for ECCC)	Nuns' Island	45.4702	-73.5399	0	CO, NO, NO_2, NO_x, SO_2, O_3, $PM_{2.5}$, PM_{tot}, VOC
BOURASSA (ECCC)	Brossard	45.4430	-73.4686	6.3	NO, NO_2, O_3, $PM_{2.5}$
Longueuil (Parc Océanie for ECCC)	Longueuil	45.5221	-73.4881	2.5	NO, NO_2, O_3, $PM_{2.5}$
VERDUN	Montréal	45.4717	-73.5722	2	NO, NO_2, O_3, $PM_{2.5}$

An overview of the results for June 15 to August 31, 2014 is presented in the sections that follow and in Table 19.

Table 19 – Summary of Air Quality Monitoring Results for Île-des-Soeurs 1 Station

PARAMETER	CONCENTRATION						
	PM_{TOT} (µg/m³)	$PM_{2.5}$ (µg/m³)	NO (PPB)	NO_2 (PPB)	SO_2 (PPB)	CO (PPB)	O_3 (PPB)
CAR[1] Baseline value	24h-120	24h-30	–	1h-220 24h-110	24h-110	1h-30000 8h-11000	1h-82 8hr-65
CUM[2] Baseline value	24h-150	–	1h-1000	1h-213 24h-106	1h-500 24h-100	1h-30000 8h-13000	1h-82 8h-38 24h-25
Hourly average	42.7	15.3	9.4	11.5	0.8	251.5	23.0
Hourly median	39.9	14.2	6.6	10.4	0.4	241.8	22.2
Hourly maximum	236.5	136.6	97.5	41.7	15.7	658.2	53.9

REF: Environment Canada for Infrastructure Canada. (2014). Air Quality Assessment in the New Bridge for the St. Lawrence Corridor.
1 CAR: Clean Air Regulation, Gouvernement du Québec.
2 CUM: Communauté urbaine de Montréal, By-law 2001-10.

3.1.7.2.1 NO

The measurements taken at Nuns' Island station 1 were significantly higher than those taken at the Longueuil and Brossard stations (ECCC) as well as higher than those taken in Verdun, although to a lesser extent. Note that the Verdun station measurements were affected by traffic, as this station is located only 300 m from Highway 15.

3.1.7.2.2 NO_2

The measurements taken at Nuns' Island station 1 were significantly higher than those taken at the Longueuil and Brossard stations (ECCC) as well as higher than those taken in Verdun, although to a lesser extent. However, NO_2 concentrations never even came close to the hourly or daily limit (220 ppb) at any of the sampling stations, with the highest value being 41.7 ppb measured at the Nuns' Island station.

3.1.7.2.3 CO

This parameter was only measured at the Nuns' Island 1 sampling station. The CO hourly concentration never came close to the 30 ppm limit. The maximum value recorded was 0.66 ppm.

3.1.7.2.4 SO_2

The SO_2 measurements taken at Nuns' Island station 1 were very low compared to the limits of 110 ppb for the New Champlain Bridge project. The daily average concentrations of SO_2 never reached the limits. The maximum value recorded was 16 ppb.

3.1.7.2.5 Particulates ($PM_{2.5}$ and PM_{tot})

For $PM_{2.5}$, the particulate concentrations were higher at the Nuns' Island 1 station compared to those in Longueuil and Brossard (ECCC), with the maximum values being much higher at that location. During one day, the concentrations at the Nuns' Island 1 station reached the limit of 30 ug/m^3, with the maximum value for all the data having been measured at that time.

As with $PM_{2.5}$, the PM_{tot} concentrations were always higher at station Nuns' Island 1 compared to those in Longueuil and Brossard (ECCC). However, the highest average daily concentration of 90 ug/m^3 was recorded at the Longueuil and Brossard stations (ECCC). All the PM_{tot} measurements were below the limit of 120 ug/m^3.

3.1.7.2.6 O_3

Ozone concentrations were similar for all the stations, which means that they vary more regionally than locally. Hourly concentrations did not exceed the limits at any location, but the limits for the 8h and 24h periods were exceeded several times.

3.1.7.2.7 Summary

In summary, the 24-hour NO, NO_2, CO and SO_2 concentrations and the $PM_{2.5}$ and PM_{tot} parameters recorded at Nuns' Island station 1 did not exceed the limits for the New Champlain Bridge project, with the exception of parameter $PM_{2.5}$ for one day, which was likely linked to a specific local event (Environment Canada, 2014). Exceedances to O_3 were attributed to regional emissions, which suggests that the immediate area where sampling was performed was not causing the exceedances.

3.1.7.3 Air quality measurements during the construction of the New Champlain Bridge

For the construction of the New Champlain Bridge, air quality sampling stations (Nuns' Island and Brossard) were installed at each end of the construction site in 2015. The measurements are available for four basic periods (1h, 3h, 8h and 24h), based on the parameter being monitored. The two stations remained on site for the entire construction phase, which was scheduled to end in 2019. The location of the two stations is shown in Figure 29. The following parameters were measured: $PM_{2.5}$, PM, NO, NO_2, SO_2, O_3 and CO at ground level. Furthermore, the Nuns' Island station measured PM_{tot}. This station is located about 250 m from Nuns' Island station 1 (Figure 29).

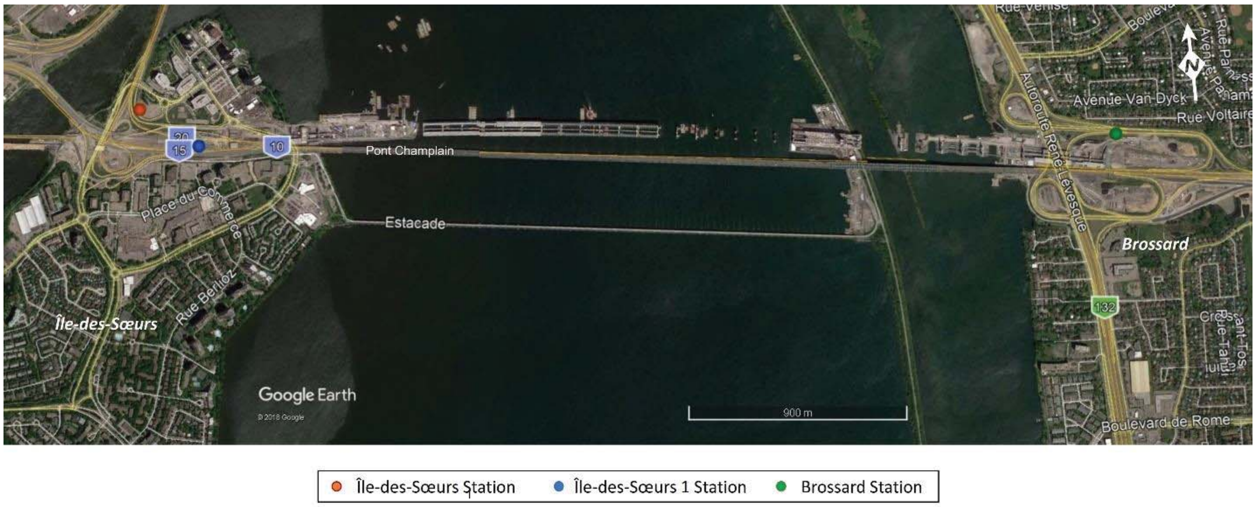


Figure 29 – Location of air quality monitoring stations in the New Champlain Bridge area

In general, although the regulatory limits were exceeded a few times during the construction of the New Champlain Bridge, INFC mentioned that the number of exceedances decreased as construction progressed through the implementation of the following mitigation measures, which proved efficient (personal communication with Philippe Larouche, JCCBI, on March 13, 2019):

- Tire washing station;
- Paving of certain work site roads generating dust;
- Use of dust suppression equipment;
- Stabilization of stockpiles.

3.1.7.3.1 Lead, silica and asbestos

Based on an assessment of anticipated emissions for the deconstruction project, lead and silica may be respectively released during the removal of the painted structure and the cutting, sawing, crushing and loading of concrete materials. Some asbestos may also be found in materials.

3.1.7.3.1.1 Lead

In 2007, as part of ECCC's NAPS program, ambient concentrations of lead were measured at three locations in Montreal using a dichotomous sampler of total suspended particulates. Annual average concentrations ranged from 0.002 to 0.003 ug/m³. The criterion for lead (annual average) is 0.1 µg/m³ (CAR). As lead concentrations are correlated with dust levels, adding a mitigation measure that involves spraying dust sources limits lead concentrations.

3.1.7.3.1.2 Silica

Silica is a major component of concrete, and sawing and crushing operations during deconstruction could release some into the air. The presence of silica in the ambient air is a relatively recent concern, and there have been few baseline studies for urban environments such as Brossard and Nuns' Island (ECCC). To provide information on the presence of airborne silica, ECCC conducted numerous studies on urban environments in Canada.

According to a review of the sampling conducted by the ECCC's NAPS in 2009, the following concentrations were obtained for 1,549 samples collected at 24 Canadian urban sites:

- Ambient air concentrations ranged from 0.73 to 8.77 ug/m³;
- The 5th percentile of data was 0.92 µg/m³;
- The 90th percentile of data was 6.48 µg/m³;
- The data average was 3.73 µg/m³.

Three of the twenty-four urban sites were in Montreal. The lowest concentrations were measured in Point Petre, Ontario, and the highest in Edmonton, Alberta.

3.1.7.3.1.3 Asbestos

Some construction materials can contain asbestos. In such a case, the asbestos will have to be removed in accordance with the methods prescribed by applicable laws prior to deconstruction.

3.1.7.4 Meteorology

The ECCC weather stations closest to the project for which Canadian Climate Normals (ECCC, 2019) are currently available from 1981 to 2010 are:

- Montreal/Saint-Hubert A – Climate identification: 7027320 (Quebec; 45°31' N 73°25' W).

This overview uses the Canadian Climate Normals from 1981 to 2010, the most recent ones published by the federal government. All data provided as part of this dataset are based on a period of at least 20 years.

The project site is located about 5 km southwest of the Saint-Hubert A weather station.

3.1.7.4.1 Temperature

The average monthly temperature data are provided in Table 20.

Table 20 – Average monthly temperature (°C)

STATION	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUGUST	SEP	OCT	NOV	DEC	ANNUAL AVERAGE
Saint-Hubert A	-10.4	-8.2	-2.5	5.7	12.9	17.9	20.6	19.5	14.7	7.9	1.5	-5.8	6.2

Here is a summary of the average monthly temperature for the Saint-Hubert A weather station:

- Average monthly temperature of 6.2 ° C;
- The average maximum temperature was estimated at 26.0° C in July;
- The average minimum temperature was estimated at -14.4 °C in January;

3.1.7.4.2 Precipitation

The average monthly precipitation data are provided in Table 21.

Table 21 – Average monthly precipitation (mm)

STATION	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUGUST	SEP	OCT	NOV	DEC	ANNUAL TOTAL
Saint-Hubert A	75.8	61.9	71.6	82.7	81.7	87.3	96.8	88.3	84.5	87	104.3	88.8	1010.6

The average annual precipitation at the station is estimated at 1,040.6 mm.

3.1.7.4.3 Wind

To obtain the conditions for the east and west shores of the bridge, wind statistics from the 1981-2010 Canadian Climate Normals database for the St-Hubert A and Trudeau A weather stations were used. The predominant wind direction for the area was mainly from the west in the winter, from the west in the spring, from the south-west in the summer, and from the west in the fall. A summary of the predominant wind direction is provided in Table 22.

Table 22 – Predominant wind direction

STATION	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUGUST	SEP	OCT	NOV	DEC	ANNUAL AVERAGE
St-Hubert A	W	W	W	N	S	SW	SW	SW	W	W	W	W	W
Trudeau A	W	W	W	W	SW	SW	SW	SW	W	W	W	W	W

At the Saint-Hubert A station, the average annual wind speed was 15.0 km/h and the maximum gust speed was 145 km/h. At the Trudeau A station, the average annual wind speed was 14.4 km/h and the maximum gust speed was 161 km/h. The data on average and maximum wind speeds are provided in Table 23 and Table 24.

Table 23 – Average monthly wind speed (km/h)

STATION	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUGUST	SEP	OCT	NOV	DEC	ANNUAL AVERAGE
Saint-Hubert A	16.9	16.1	16.4	16.5	15.1	14.1	12.8	11.9	13.1	14.7	15.9	15.9	15.0
Trudeau A	16.0	15.5	15.6	15.9	14.6	13.2	12.4	11.8	12.6	14.2	15.3	15.6	14.4

Table 24 – Maximum gust speed (km/h)

STATION	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUGUST	SEP	OCT	NOV	DEC	ANNUAL MAXIMUM
Saint-Hubert A	113	145	137	122	113	105	113	109	100	105	130	113	145
Trudeau A	117	138	161	106	103	111	126	105	97	117	113	103	161

The graphical representations of the wind rose and the diurnal differences at A Trudeau station over the recording period (1954-2016) are provided in Figure 30.

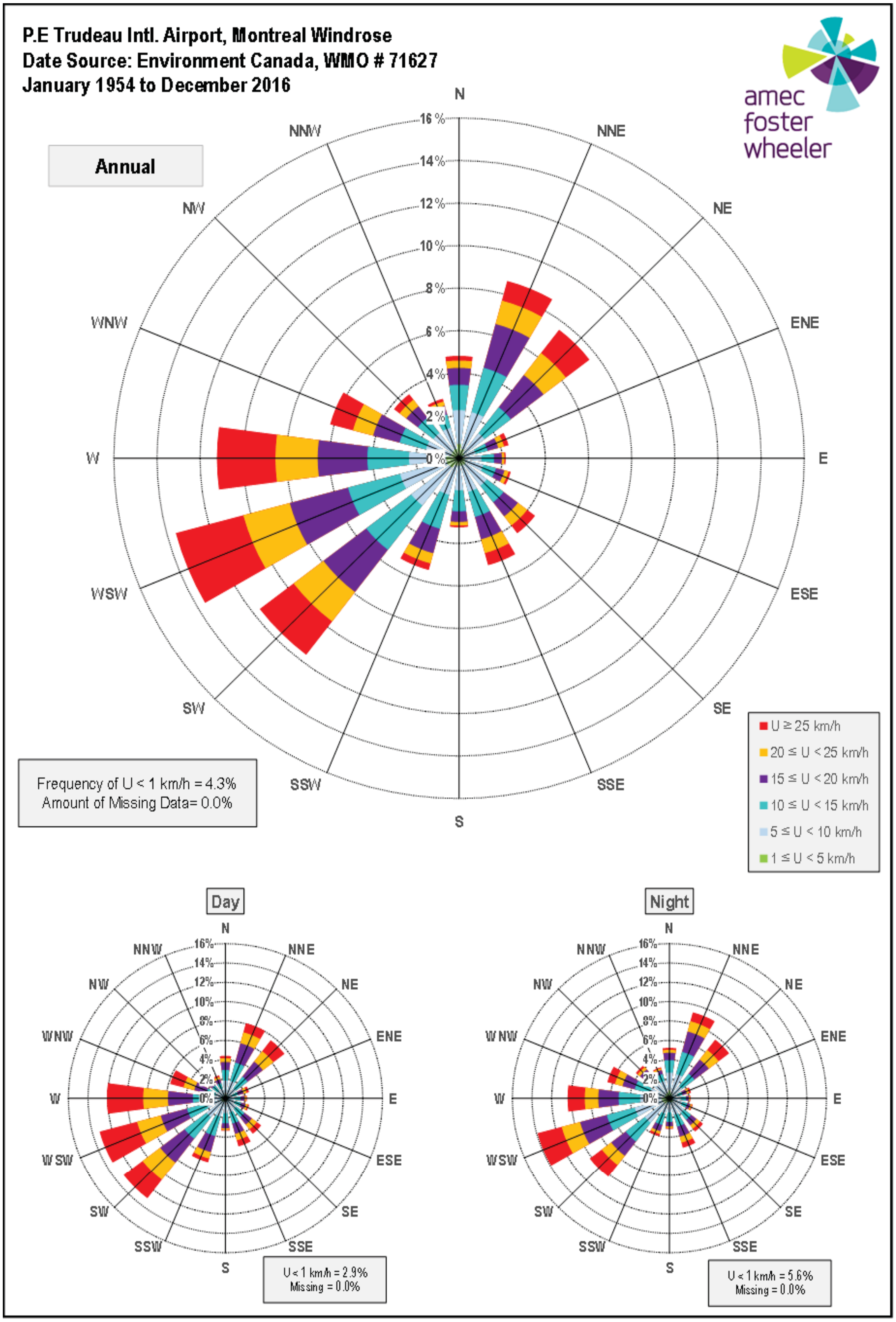


Figure 30 – Wind rose and diurnal differences at Trudeau A station (1954-2016)

3.2 BIOLOGICAL ENVIRONMENT

3.2.1 FLORA

3.2.1.1 Aquatic plant communities

Surveys of aquatic plant communities were done in 2012 as part of the 2013 EA (Dessau-Cima+, 2013). However, they did not cover the entire area upstream of the Existing Champlain Bridge up to the Ice Control Structure. In addition, the presence of jetties for the construction of the New Bridge for a number of years has resulted in reductions in flow at some locations, which modified the distribution of plant communities. A survey was done in 2018 to obtain an up-to-date status of the plant communities. The areas covered in 2012 and 2018 are shown on Map 4.

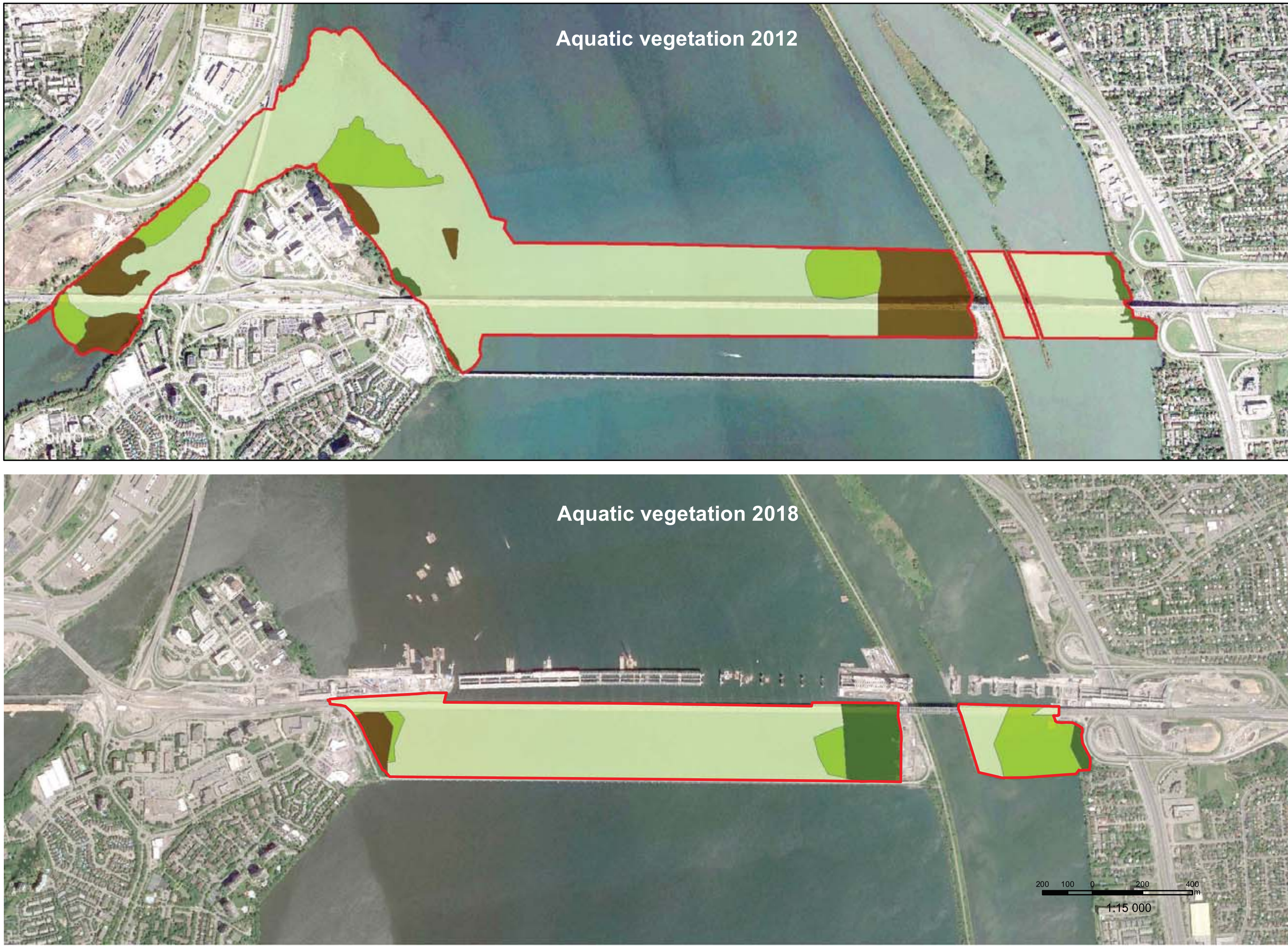
Dessau-CIMA+ identified and delineated the aquatic plant communities on August 20 and 22, 2012 (Dessau-CIMA+, 2013). The field team used a boat, underwater camera and GPS to delineate and inventory the aquatic plant communities. The plant communities were mapped based on the percentage of plant coverage on the bed of the St. Lawrence River. The aquatic species inventoried in the plant beds in 2012 by Dessau-CIMA+ are listed in Table 25.

Table 25 – Floristic composition of aquatic plant communities

STRATUM	COMMON NAME	LATIN NAME
Herbaceous	Elodea	*Elodea canadensis*
	Yellow cowlily	*Nuphar variegata*
	Large-leaved pondweed	*Potamogeton amplifolius*
	Sago pondweed	*Stuckenia pectinata*
	Clasping pondweed	*Potamogeton perfoliatus*
	Pondweed	*Potamogeton sp.*
	Erect arrowleaf	*Sagittaria rigida*
	Great bulrush	*Schoenoplectus tabernaemontani*
	Tapegrass	*Valisneria americana*

During the 2018 aquatic surveys, the aim was to delineate the aquatic plant communities and establish the percentage of aquatic vegetation cover, though without identifying all the plants they contained. Map 4 presents the delineation of the aquatic plant communities in 2012 and 2018.

A marked growth in the aquatic plant communities is noted upstream of the jetty east of Nuns' Island. This jetty has a localized impact on the water flow in this area. In fact, before the jetty was created, current speeds were greater and aquatic vegetation was only found near the Nuns' Island shore. Now there is a lentic flow where there was previously fast-flowing water before the jetty was created. The low water flow in this area appears beneficial for the establishment of aquatic vegetation, which now covers a surface area of about 27,720 m² compared to only 2,000 m² in 2012.



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Canada

Study area

Aquatic vegetation cover (%)

- 75-100
- 50-75
- 25-50
- 0-25

DECONSTRUCTION OF EXISTING CHAMPLAIN BRIDGE (2017-2022)
CONTRACT No. 62555
TARGETED ENVIRONMENTAL ANALYSIS

Aquatic vegetation cover from 2012 to 2018

March 2019

Coordinate system: NAD83 MTM 8

Base map: Google 2012 and 2018

Parsons Tetra Tech Amec Foster Wheeler

Map 4

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The aquatic plant community on the right shore of the Greater La Prairie Basin regressed slightly compared to 2012. The presence of the jetty in this area causes the current to flow faster at the western boundary of the plant community that was delineated in 2012. Once work on the New Champlain Bridge has been completed and the jetty removed, flow conditions will return to normal. The grass bed should then return to its initial surface area.

In the Lesser La Prairie Basin, a large area of habitat is now covered with more than 25 % of aquatic vegetation. In fact, the aquatic plant communities identified in 2012 (16,570 m²) have increased in size and now cover a surface area of roughly 80,400 m². Since the flow in the Lesser La Prairie Basin is lentic in the summer, it is unlikely that the presence of the jetty contributed to the growth of the aquatic plant communities in this area. At present, the jetty may locally modify the flow in the spring, making conditions more suitable for the development of aquatic vegetation in the area.

3.2.1.2 Special status species of flora

Special status plant species include species specific to habitats with rare physical conditions, species with declining populations because of disease or human pressures, or species sensitive to disturbances.

As stated by PTA (2017), it is important to note that the study area is almost exclusively occupied by anthropogenic environments such as road infrastructures, buildings and construction sites for the New Bridge. The surface area for plant habitats is therefore very limited. The habitats found in the study area include cottonwood poplar stands, black locust stands, uncultivated grassland, common water reed marshes and treed swamps (Dessau-Cima+, 2013). These habitats are young, disrupted and largely made up of ruderal and alien species. The potential for habitats for special-status species is therefore low.

The list and status of protected species differ depending on the level of government:

a) At the federal level:

According to the Committee on the Status of Endangered Wildlife in Canada (COSEWIC, 2017), four species are endangered, thirteen are threatened and seven are of special concern for Quebec. Note also that six previously classified species are no longer considered at risk. Of these species, four potentially occur in the study area, (Table 26), primarily in the mobilization areas and the in-water work areas, as depicted in Chapter 2.

Table 26 – List of federal special-status plant species for the study area

STATUS	COMMON NAME	SCIENTIFIC NAME
Endangered	American ginseng	*Panax quinquefolius*
	Butternut	*Juglans cinerea*
Threatened	American water-willow	*Justicia americana*
Special concern	Green dragon	*Arisaema dracontium*

Based on the preferential habitats of the four above species, only the butternut and the American water-willow could occur in the study area. The butternut frequently occurs on shores, while the American water-willow occurs in marshes and swamps with water-saturated muddy soil.

b) At the provincial level:

According to AECOM (2017) and PTA (2017), the CDPNQ mentioned three occurrences of species at risk near the Existing Champlain Bridge (Table 27).

Table 27 – List of provincial special-status plant species for the study area

STATUS	COMMON NAME	SCIENTIFIC NAME
Threatened	American water-willow	*Justicia americana*
Likely to be designated	Normal sedge	*Carex normalis*
	Peachleaf willow	*Salix amygdaloides*

These three species are part of the 64 species of vascular plants at risk in the Montreal-Longueuil area (Tardif *et al.,* 2016). Observations of the three species correspond to historic accounts.

Inventories were conducted to check for the occurrence of status species as part of the 2013 EA and the biodiversity inventory on JCCBI land (AECOM, 2017).

DESSAU-CIMA+ (2013) reported the occurrence of the rough water-horehound, a species likely to be designated threatened or vulnerable, in uncultivated grassland at Nuns' Island, between the St. Lawrence and access to the Ice Control Structure (Map 2, 0).

AECOM (2017) reports that "no special-status plant species was inventoried in the restricted inventory area" (which extends from the New Bridge to the Ice Control Structure upstream, including the land portions containing the mobilization areas used for the deconstruction of the Existing Champlain Bridge). They mention shagbark hickory, a species likely to be designated threatened or vulnerable, at station V17 in Brossard. Station V17 is located just outside the study area (north of Avenue Tisserand) (Map 2, 0).

Note that the species likely to be designated are species that are monitored by the CDPNQ but that have no legal protection. However, it is recommended that their habitat not be disrupted, or at least that mitigation measures be implemented to minimize the impacts of the project activities on these species.

3.2.1.3 Invasive alien species (flora)

Alien species are species that have become established in areas outside of their natural range. They become invasive when their population dynamics supersede that of native species. This causes the loss of biodiversity and economic losses associated with control measures.

The federal and provincial governments have implemented programs that deal with invasive alien species (IAS):

a) At the federal level:

The Invasive Alien Species Partnership Program (Government of Canada, 2012) lists a total of 142 problem plants (Appendix 4).

b) At the provincial level:

The MELCC has set up a database on the occurrence of invasive alien species as well as a watch list since 2016. This list contains 23 terrestrial plants and 20 wetland plants (0).

In the study area, numerous invasive alien species (IAS) were identified (see Map 2, 0) by DESSAU-CIMA+ (2013) and AECOM (2017) during their inventories. Their occurrence is normal since the entire area is highly disrupted. In addition to vegetation inventories, AECOM (2017) conducted a specific inventory of IAS based on the provincial list. Map 2 (0) shows the following in the study area: *Panais sativa* (abbreviated as "PASA" on the map) and *Phragmites australis* (abbreviated as "PHAU" on the map).

With a view to proper work site management, these species must be dealt with carefully to prevent them from spreading. At the federal level, IAS management is not associated with any specific regulations, but guidelines are provided. Since provincial regulations are more restrictive, they must be followed.

At the provincial level, when residue from IAS or excavated soil containing a large number of IAS fragments is removed from a site, the MELCC considers these materials to be residual materials under Section 1-11° of the Environment Quality Act given that they consist of substances or materials which the holder intends to discard. Residual materials are covered by Section 66 of the Environment Quality Act, which prohibits them from being deposited or discharged at a location not authorized for their storage, treatment or elimination. However, given the quantities that must be managed in certain projects, the MELCC considers that on-site management is not considered as discarding IAS and soils. In such a case, the MELCC asks that residual materials be buried under at least 1 m of soil or unaffected materials, except for *Phragmites australis*, where the thickness must be 2 m. These residual materials may also be reclaimed via a treatment that allows the residue to be reused such as through composting or screening.

3.2.2 FAUNA AND HABITATS

3.2.2.1 Ichthyofauna and aquatic habitats

3.2.2.1.1 Study area

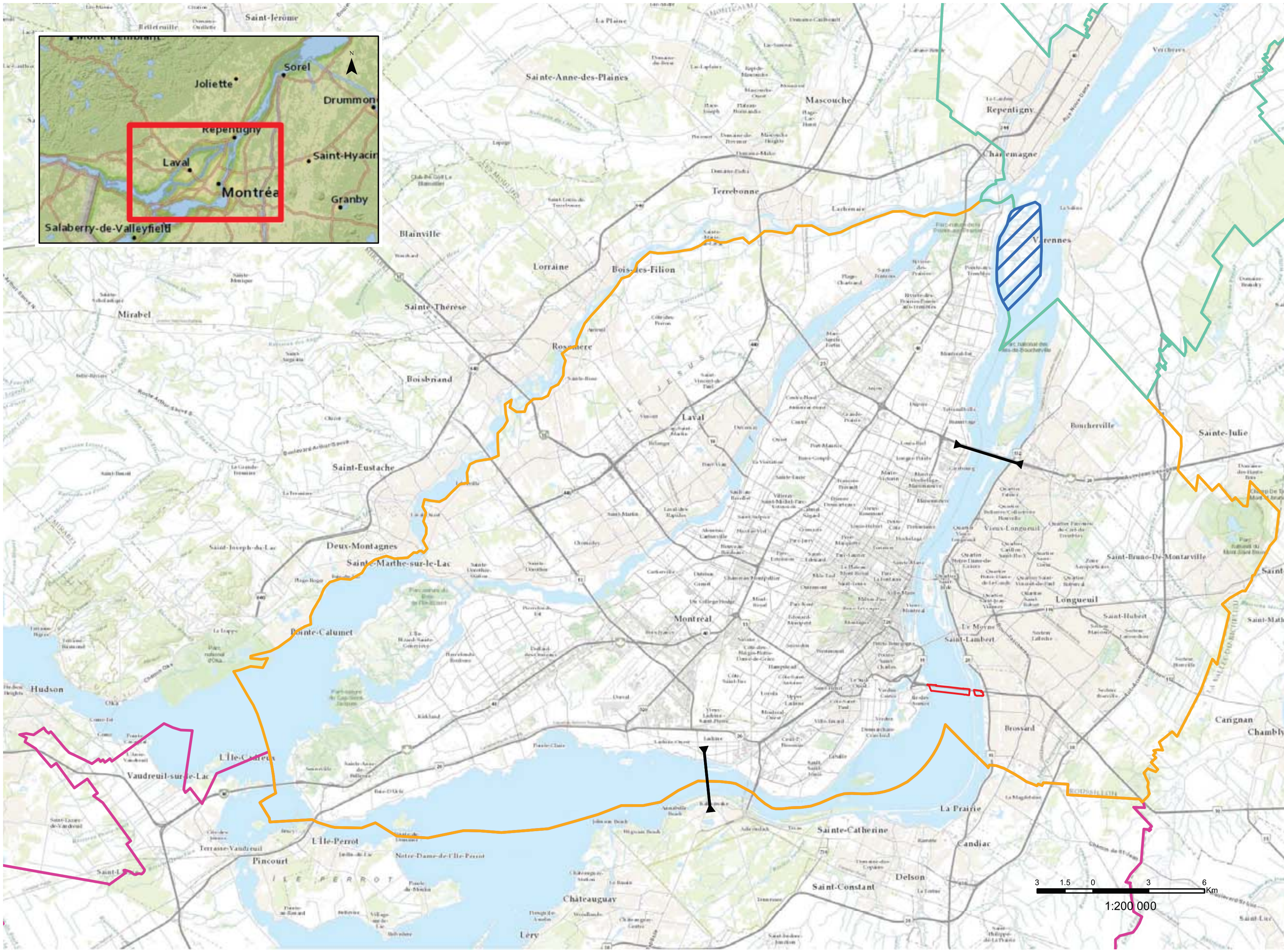
The aquatic-environment study area covered by Dessau-CIMA+ as part of the 2013 EA was approximately 4.5 km long and extended out along both sides of the Existing Champlain Bridge (100 m upstream and 200 m downstream) (Map 5). In addition to this area, there is a potential spawning ground downstream from Nuns' Island extending for more than 1 km downstream from the Existing Champlain Bridge. The initial study area thus covered the entire sector that could be affected by construction work and, over the long term, by the New Bridge. The areas covered by the initial study area are the Lesser La Prairie Basin and the Greater La Prairie Basin, as well as the Nuns' Island channel.

In 2018, an additional characterization of the aquatic habitats was carried out by PTA between the Champlain Bridge and the Champlain Bridge Ice Control Structure as well as in the Lesser La Prairie Basin. No surveys were conducted in the Nuns' Island channel downstream of the Existing Champlain Bridge and in the Seaway. In fact, the study area covered by the 2018 surveys is slightly adjacent to the Dessau-CIMA+ study area in the Lesser and Greater La Prairie basins over about 120 m upstream up to the Ice Control Structure (Map 6).

Following the meeting between JCCBI and DFO in August 2018, the study area for the aquatic habitat inventory was reviewed to add checkpoints downstream of certain piers of the Existing Champlain Bridge (see Map 6). There were about 15 checkpoints downstream of the piers of the Existing Bridge where there is a rocky substrate in order to determine whether there is sediment build-up. The presence of sediment behind some piers could affect the method used for pier deconstruction. In addition, some habitats which showed heterogeneity in the area during the initial characterization in 2012 (substrate under-represented in the study area or occurrence of aquatic plant communities) were revisited for follow-up and to compare any differences.

3.2.2.1.2 Literature review

The 2013 EA described the study area through a search of government departments and agencies that had conducted work involving fish and fish habitats. A wealth of information on the species in this area and their habitats was available, and served as a basis to complete the description of the environment. Since fish sometimes travel over long distances, the information that was gathered had to cover an area larger than the actual study area. The literature review on the habitats and fish communities conducted by Dessau-CIMA+ in the 2013 EA thus covers a far larger area, namely, from the start of the Lachine Rapids (about 15 km upstream of the Champlain Bridge) to the Louis-Hippolyte-La Fontaine Bridge-Tunnel (approximately 15 km downstream of the Existing Champlain Bridge) (Map 5).



DECONSTRUCTION OF EXISTING CHAMPLAIN BRIDGE (2017-2022)
CONTRACT No. 62555
TARGETED ENVIRONMENTAL ANALYSIS

Study area for fish and location of Areas of Prime Concern

March 2019

Coordinate system: NAD83 MTM 8

Base map: Esri

ZIP source: Stratégies Saint-Laurent

Parsons
Tetra Tech
Amec Foster Wheeler

Map 5

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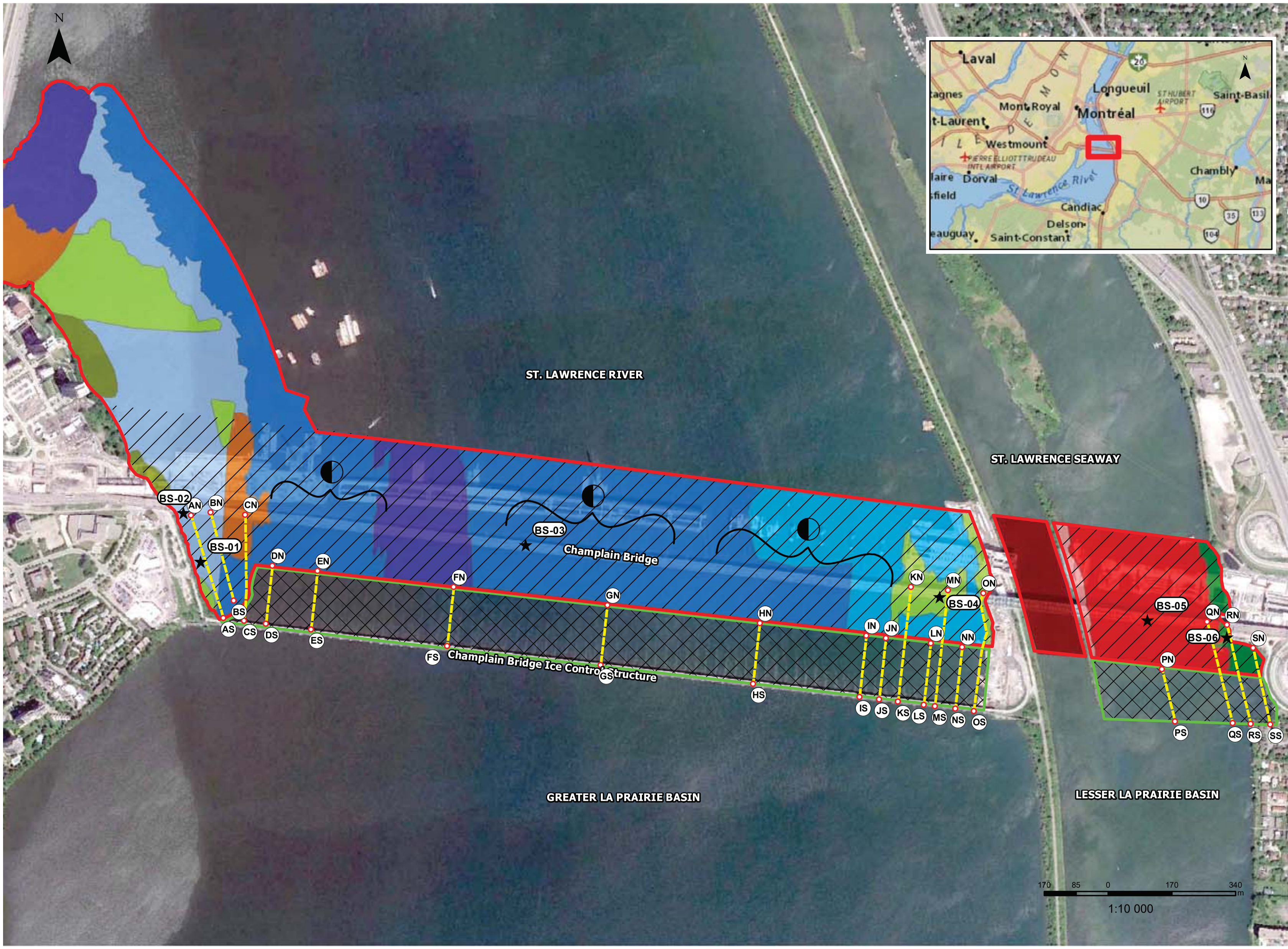

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STUDY AREA

- FISH HABITAT (2012)
- AQUATIC INVENTORIES (2018)
- SEDIMENTS, BENTHOS AND FRESHWATER MUSSELS
- FISH HABITATS
- SAMPLING STATIONS – BENTHOS AND SEDIMENTS
- TRANSECT – FISH HABITAT
- CHECKPOINTS – FISH HABITAT

DECONSTRUCTION OF EXISTING CHAMPLAIN BRIDGE (2017-2022)
CONTRACT No. 62555
TARGETED ENVIRONMENTAL ANALYSIS

WORK PLAN
2018 AQUATIC INVENTORIES

March 2019

Coordinate system: NAD83 MTM 8

Aquatic habitats: Environnement Illimité Inc. 2012
Base map: Google
© Government of Canada.
© Government of Quebec

170 85 0 170 340 m
1:10 000

Parsons Tetra Tech Amec Foster Wheeler

Map 6

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Numerous surveys and knowledge syntheses were carried out in the course of establishing the priority intervention zone (ZIP) committees by Stratégies Saint-Laurent (Stratégies Saint-Laurent, 2012; Armellin *et al.*, 1994, Armellin *et al.*, 1995; Armellin *et al.*, 1997). The study area is partly made up of the Haut Saint-Laurent and Jacques-Cartier ZIPs (Map 5).

More recent data were also consulted. More specifically, the results of the biodiversity inventory on JCCBI property (Aecom, 2017) were used in this report. In addition, the results of the information request to the CDPNQ regarding fish and fish habitats in a 8-km radius around the Existing Champlain Bridge were incorporated and presented in this report.

3.2.2.1.3 Survey method and description of habitats

A complete survey of the study area documenting fish habitats was carried out in August 2012 by Dessau-CIMA+ (2013 EA). In August 2018, the PTA aquatic habitat survey focused on the area between the Existing Champlain Bridge and the Ice Control Structure.

Dessau-CIMA+ (2013) used the classification proposed by Armellin and Mousseau (1998) to categorize the aquatic habitats in the study area based on four biophysical characteristics: flow rate, average depth, substrate particle size, and presence or absence of aquatic vegetation. This approach enabled the main habitats found in the area to be quickly identified and grouped into 24 types of habitats based on their specific parameters. The classification criteria chart used to identify the 24 aquatic habitats is presented in Appendix 5.

Once the types of habitat are defined, their main functions can be quickly identified (e.g. breeding for calm-water or fast-water species, feeding), along with their respective sensitivity. Habitat sensitivity may vary depending on the area and the species of fish inventoried in a specific system (e.g. occurrence of salmonids, walleye or lake sturgeon). The following habitats are generally considered sensitive or not sensitive by DFO:

- Sensitive: 1, 2, 3, 4, 6, 8, 12, 13, 13a, 14, 16, 18, 21 and 22;
- Not sensitive: 1a, 5, 7, 9, 10, 11, 15, 17, 19, 20, 23 and 24.

Habitat sensitivity depends, namely, on the habitat functions that are fulfilled (e.g. spawning, rearing, feeding) and the species that are present. Habitats considered sensitive that contain aquatic vegetation (2, 4, 6, 8, 12, 14, 16 and 18) are likely to be used for the spawning and rearing of phytolithophilous and phytophilous species as well as for the feeding of several species. Habitats 3, 13, 13a, 21 and 22 contain no aquatic vegetation but show some sensitivity. Type 13, 21 and 22 habitats present a reproductive potential for lithophilous species in fast water, while type 3 habitats present a reproductive potential for lithophilous species in slow water. Moreover, types 3 and 13a habitats represent a significant potential feeding area in the summer.

A type 1 habitat is a floodplain that can be used for the spawning of phytolithophilous and phytophilous species.

Finally, any future fish habitat development in the study area was considered as a sensitive fish habitat.

3.2.2.1.3.1 Survey method for the 2012 environmental assessment (Dessau-CIMA+)

The Dessau-CIMA+ characterization of the aquatic habitats was conducted from August 20 to 24, 2012 during a severe low-water period.

The above study area survey defined the flow facies, substrate composition and aquatic vegetation. This information, along with the bathymetric survey and the data on vegetation in the floodplain (see section 3.2.1.1), made it possible to separate the study area into zones representing an aquatic habitat type. A classification criteria chart used to determine the type of aquatic habitat is found in Appendix 5.

3.2.2.1.3.2 Survey method for the 2018 additional characterization (PTA)

The approach proposed by DFO to characterize fish habitat is based on the method used for the characterization of river habitats, adapted from Armellin and Mousseau. Since this characterization method was also used by Dessau-CIMA+ in 2012, the surveys and results from 2018 supplement the 2012 data for the new characterized zone and enable a direct habitat comparison to be made for the zones affected by the jetties.

The characterization surveys for the substrate and plant communities were conducted from August 24 to 27, 2018. An underwater camera was used to take pictures of the substrate and aquatic vegetation (Photo 12). The transects were determined based on those characterized by Dessau-CIMA+. Some transects were extended upstream to cover the new study area, and transects were added in the Dessau-CIMA+ study area to again characterize some sensitive habitats (e.g. sensitive habitats near jetties). The video images of the 19 transects covering the study area were georeferenced and saved. Current speeds were measured with a current meter near the surface at the beginning and end of the transects. Based on environmental conditions during the sampling (e.g. current speed), the video recordings were sometimes made directly by a diver or from the boat with a camera attached to a ballasted metal cage.

Photo 12 – Aquatic survey using a diver

The habitat characterization results are presented by habitat component as well as for all habitat components combined (raw data presented in Appendix 6). These parameters are correlated with the potential habitats of the various species found in the area in order to establish their potential. The spring and summer fishing data collected by Aecom (2017) were used to define suitable habitats for the species, especially for status species.

3.2.2.1.3.3 Potential spawning habitat

Spawning potential was assessed based on criteria established by Lavoie and Talbot (1984) for six fish groups (guilds) using similar spawning habitats: lithophilous in fast-flowing water, lithophilous in calm water, phytolithophilous, phytophilous, lithopelagic and pelagic. The biophysical characteristics of the watercourse considered when determining spawning potential are: flow velocity, average depth, substrate particle-size classes and aquatic and semi-aquatic vegetation density (environment type). Table 28, which presents this information, was revised to include all the species found in the study area and to associate the 24 types of habitat to the various guilds. The spawning habits and breeding periods for the fish species potentially present in the study area are presented in the “Fish species” table in Appendix 7.

Signature on the Saint Lawrence (SSL) intends to carry out fish habitat work to expand a potential spawning ground next to habitat 22 (characterized in 2012). This spawning ground developed for lithophilous species in fast water will be situated just upstream of the proposed jetty on the Nuns’ Island side (see section 6.3.1.4.1 in volume 2 for the location).

3.2.2.1.3.4 Potential rearing and feeding habitats

In general, rearing and feeding habitats were considered in light of the type of habitat used by a large proportion of the species in the study area. The “List of fish species” table in Appendix 7 contains the preferential habitats and food preferences of fish likely to be found in the study area. The habitats of status species or species important for fishing were specifically examined to ensure that the impact assessment considered the needs of these species. This made it possible to evaluate the most sensitive parts of the study area and to assess the environmental impact on the main species.

Table 28 – Biophysical characteristics of the various reproductive guilds and associated fish species

Reproductive guild	Definition	Biophysical characteristics								Species in the study area	Type of associated habitat
		Current (m/s)	Depth (m)	Water temperature (°C)	Substrate	Season of use	Vegetation	Turbidity	Oxygen level (ppm)		
Lithophilous in fast-moving water	Eggs deposited on a substrate generally consisting of sand or rocks where the eggs and sometimes larvae become pelagic at a given point	0.3 to 2.15	0.20 – 7.0	4 - 18	Coarse sand, gravel, rock, blocks	SP – SU – F	Rare	Clear to turbid	≥ 8	Smallmouth Bass, Channel Catfish, Cutlip Minnow, Silver Redhorse, Copper Redhorse, River Redhorse, Greater Redhorse, Shorthead Redhorse, Eastern Sand Darter, Walleye, Sauger, Channel Darter, Lake Whitefish, Silver Lamprey, Sea Lamprey, Common Shiner, White Sucker, Northern Sucker, Blacknose Shiner, Longnose Dace, Blacknose Dace, Landlocked Arctic Char, Brook Trout, Fallfish, Atlantic Salmon, Chinook Salmon, Coho Salmon, Rosyface Shiner, Rainbow Trout, Brown Trout, Cutthroat Trout	13-15-17-19-20-21-22-23-24
Lithophilous in slow-moving water	Eggs deposited on substrate consisting of blocks, cobbles, pebbles, gravel or sand in slow-flowing water	< 0.3	≥ 0.1	4 – 18	Coarse sand, gravel, rock	SP – SU – F	Rare	Clear	≥ 8	Quillback, Longear Sunfish, Bluegill, Rock Bass, Rainbow Smelt, Common Logperch, Round Goby, Black Crappie, Creek Chub, Allegheny Pearl Dace, Trout-perch, Spottail Shiner, Lake Trout	3-5-7-9
Phytolithophilous in calm water	Eggs deposited on substrate consisting of blocks, cobbles, pebbles, gravel or sand in medium-to fast-flowing water	≤ 0.3	≤ 4	7 – 24	Silt, gravel, rock, organic matter	SP – SU	Average density: aquatic and semi-aquatic	Low turbidity	6 - 8	Largemouth Bass, Brown Bullhead, White Perch, Mottled Sculpin, Slimy Sculpin, Tadpole Madtom, Stonecat, Brook Silverside, Yellowbelly, Rainbow Darter, Fantail Darter, Alewife, Longnose Gar, Spotfin Shiner, Silver Minnow, Sand Shiner, Mimic Shiner, Yellow Perch, Bluntnose Minnow, Tesselated Darter, Johnny Darter, Fathead Minnow	2-4-6-8-12-14-16
Phytophilous	Eggs laid in the water column, generally in fast-flowing water. Eggs usually hatch relatively quickly, in calmer waters often far from where they were laid.	≤ 0.3	≤ 1.2	4 - 16	Organic (plants)	SP – SU – F	Dense: aquatic, semi-aquatic and terrestrial forbs	Generally little turbidity	–	Redfin Pickerel, Chain Pickerel, Grass Pickerel, Crucian Carp, Carp, Five-spined Stickleback, Three-spined Stickleback, Banded Killifish, Northern Pike, Muskellunge, Bridle Shiner, Golden Shiner, Blackchin Shiner, Bowfin, Central Mudminnow, Northern Redbelly Dace	1-4
Lithopelagic	Eggs laid on aquatic or terrestrial vegetation (living or not)	0.12 to 2.15	0.2 - 5	0 - 18	Sand, gravel, rock, blocks, frazil	W – SP – early SU	–	Clear to turbid	Close to saturation	Gizzard Shad, White Bass, Striped Bass, Lake Sturgeon, Atlantic Sturgeon, Mooneye, Burbot, Freshwater Drum	13-17-21-22-23
Pelagic	Eggs laid on submerged plants, on wood, or in natural cavities. Bottoms are made up of various materials (silt, sand, gravel or rock) covered with organic matter or not.	0.2 to 1.0	0.5 – 10	13 – 18	Sand, gravel, cobbles	SP - SU	–	Clear to turbid	Close to saturation	American Shad, American Eel*, Grass Carp, Emerald Shiner	13-17-20-21-22-23-24

Legend: Season of use – SP, spring; SU, summer; F, fall; W, winter

** The American Eel spawns in saltwater in the Sargasso Sea*

Source: Adapted from Lavoie and Talbot, 1988

3.2.2.1.4 Fish population and habitat

3.2.2.1.4.1 Fish population

According to 2013 EA, historical data show that close to 100 species of fish are potentially present in the Champlain Bridge area. These species are present in an area encompassing 15 km upstream and downstream of the Existing Champlain Bridge, therefore, over about 30 kilometres of the St. Lawrence River. In the document *Synthèse des connaissances sur les communautés biologiques du secteur d'étude des bassins de La Prairie* (Armellin *et al.*, 1997), Mongeau *et al*. (1980) are cited as reporting a total of 67 species of fish inventoried between 1963 and 1977 in the area containing the Lesser and Greater La Prairie basins as well as the Lachine Rapids.

Table 29 lists the 98 species whose occurrence is confirmed or likely in the study area. These species were identified based on the literature review and wildlife inventories conducted by Aecom in 2016 on JCCBI properties, in particular experimental fishing in the Existing Champlain Bridge area. The two species with the largest number of catches in the area by Aecom (2017) are Round Goby (IAS) and Rock Bass, with 37% and 34 % catches, respectively (Aecom, 2017). Besides these two species, the most abundant species are White Sucker (8% of catches), Smallmouth Bass (6%), Fantail Darter (5 %), Sand Smelt (4%) and Logperch (2%). Four species of fish occur in all sections of the St. Lawrence (Nuns' Island Channel, Lesser and Greater La Prairie basins): Smallmouth Bass, American Eel, Rock Bass, and Round Goby.

The fish population in the expanded study area (15 km upstream and downstream) consists of 25 families, with the main ones being Cyprinidae (shiner and mullet), Percidae (walleye, yellow perch, dace and darter), Catostomidae (redhorse and chub) and Centrarchidae (bass and sunfish). The fish population is thus dominated by warmwater species. Most of the species that are known or suspected to be in the area spawn in the spring or early summer. Therefore, this period is considered as being sensitive for the fish in the study area. Moreover, the DFO implements a restriction period for in-water works to protect the main species of interest. These restriction periods for in-water works by type of habitat are presented in Volume 2 of the TEA.

Apart from Rainbow Trout and Brown Trout, few salmonids occur in the area. Salmonids especially occur in the Lachine Rapids. Salmonids generally spawn in the fall and their eggs incubate in the substrate over the winter to hatch in the spring. The sensitive period for these species therefore extends from fall to spring, i.e. from September 15 to May 31 for Montreal and Montérégie, according to the DFO. Since no salmonid spawning grounds were documented in the area and given the low density of salmonids in the area, it is recommended to not consider the work restriction period for salmonids.

Of the 98 species potentially occurring in the study area (Table 29), 21 have a special conservation status: American Shad, American Eel, Stripped Bass, Splitnose Rockfish, Chain Pickerel, Grass Pickerel, Stonecat, Copper Redhorse, River Redhorse, Longear Sunfish, Northern Sunfish, Rainbow Darter, Eastern Sand Darter, Lake Sturgeon, Atlantic Sturgeon, Channel Darter, Silver Lamprey, Northern Brook Lamprey, Bridle Shiner, Sunapee Trout and Rosyface Shiner. Section 3.2.2.1.4.8, Species at risk with a provincial status provides more details on these species.

Three invasive species of fish species are known or suspected to be in the study area: Round Goby, Rainbow Trout and Asian Carp (Grass Carp). More details can be found in section 3.2.2.1.4.9, Invasive alien species.

3.2.2.1.4.2 Fish habitat – Lesser La Prairie Basin

The Lesser La Prairie Basin is a section of the St. Lawrence that has been physically separated from the main stem of the St. Lawrence since the St. Lawrence Seaway was built between 1954 and 1959. The Lesser Basin has an navigable channel dredged to 8.6 m in depth along the right shore along with a dike. Fill was used to create islets separating the Seaway from the rest of the Lesser Basin. The submerged slopes of the small artificial isles created in such a way between the navigable channel and the rest of the Lesser Basin provide quality habitats for several species of fish (Robitaille, 1997). The different types of habitats characterized in the Lesser La Prairie Basin in 2012 and 2018 are shown on Map 9.

3.2.2.1.4.2.1 Baseline condition prior to the creation of the jetties – Dessau-CIMA+

The Lesser La Prairie Basin, located on the south shore of the St. Lawrence, is divided into two sections. The first is the South Shore Canal, a deeper Seaway (8.6 m) for commercial vessels, and the second is the Lesser La Prairie Basin, which was less than 5 m deep when the bathymetric survey was conducted (July 2012). Physically separated from the river current by locks, the Lesser La Prairie Basin is a lentic flow zone. When the characterization was carried out in August 2012, the water level in the Lesser La Prairie Basin was nearly 2 m higher than in the Greater La Prairie Basin. There are 36 species from 12 families in the Lesser La Prairie Basin (Armellin *et al.*, 1997; see Table 29), and these are dominated by Cyprinidae, Percidae and Centrarchidae.

As stated above, the Lesser La Prairie Basin is a lentic flow zone (see Map 7). There is fine substrate (see Map 8), little vegetation (Map 4) and the depth ranges from 2 to 5 m (type 9) in over 63% (122,180 m²) of the surface area of this sector (see Map 9). In the shallower areas, there are large aquatic plant communities (16,570 m²) such as the one along the south shore of the basin. This habitat (type 4) is a favourable breeding area for many phytolithophilous species such as bass, perch and some members of the carp family. The Seaway canal covers 25% of this area. The canal is deeper (8.6 m, type 20) and is mainly colonized by zebra mussels on a gravel substrate.

Many fish were observed during the 2012 characterization in the Seaway canal. Dessau-Cima+ (2013) has formulated the hypothesis that the passage of commercial vessels stirs up particles that attract certain invertebrates able to feed on them, including zebra mussels, which in turn attract fish in search of food.

Table 29 – List of species of fish known or suspected to be in the study area

Code[1]	Species			Family	STUDY AREA (VILLE-MARIE ZIP)			UPSTREAM (HAUT SAINT-LAURENT ZIP)	DOWNSTREAM (JACQUES-CARTIER ZIP)	AECOM		
	Common name in French	Common name in English	Scientific name		GREATER LA PRAIRIE BASIN	LESSER LA PRAIRIE BASIN	LACHINE RAPIDS			JACQUES-CARTIER BRIDGE (DOWNSTREAM)	CHAMPLAIN BRIDGE	HONORÉ-MERCIER BRIDGE* (UPSTREAM)
ACFU	Esturgeon jaune	Lake sturgeon	Acipenser fulvescens	Acipenseridae	X			X	X	X	X	X
ACOX	Esturgeon noir	Atlantic sturgeon	Acipenser oxyrinchus	Acipenseridae					X			
ALPS	Gaspareau	Alewife	Alosa pseudoharengus	Clupeidae		X		X	X			
ALSA	Alose savoureuse	American shad	Alosa sapidissima	Clupeidae			X	X	X			
AMCA	Poisson-castor	Bowfin	Amia calva	Amiidae	X			X	X			
AMNE	Barbotte brune	Brown bullhead	Ameiurus nebulosus	Ictaluridae	X	X	X	X	X		X	
AMPE	Dard de sable	Eastern sand darter	Ammocrypta pellucida	Percidae					X			
AMRU	Crapet de roche	Rock bass	Ambloplites rupestris	Centrarchidae	X	X	X	X	X	X	X	X
ANRO	Anguille d'Amérique	American eel	Anguilla rostrata	Anguillidae	X	X	X	X	X	X	X	X
APGR	Malachigan	Freshwater drum	Aplodinotus grunniens	Sciaenidae				X	X			
CAAU	Carassin (poisson rouge)	Goldfish	Carassius auratus	Cyprinidae					X			
CACA	Meunier rouge	Longnose sucker	Catostomus catostomus	Catostomidae	X		X	X	X			
CACO	Meunier noir	White sucker	Catostomus commersonii	Catostomidae	X	X	X	X	X	X	X	X
CACY	Couette	Quillback	Carpiodes cyprinus	Catostomidae				X	X			
COBA	Chabot tacheté	Mottled sculpin	Cottus bairdii	Cottidae	X		X	X	X		X	
COCL	Grand corégone	Lake whitefish	Coregonus clupeaformis	Salmonidae					X			
COCO	Chabot visqueux	Slimy sculpin	Cottus cognatus	Cottidae					X			
CTID	Carpe de roseau	Grass carp	Ctenopharyngodon idella	Cyprinidae					X			
CUIN	Épinoche à cinq épines	Brook stickleback	Culaea inconstans	Gasterosteidae			X	X	X	X		X
CYCA	Carpe	Common carp	Cyprinus carpio	Cyprinidae	X	X	X	X	X		X	
CYSI	Méné bleu	Spotfin shiner	Cyprinella spiloptera	Cyprinidae				X	X			
DOCE	Alose à gésier	Gizzard shad	Dorosoma cepedianum	Clupeidae				X				
ESAM	Brochet d'Amérique	Redfin pickerel	Esox americanus americanus	Esocidae					X			
ESLU	Grand brochet	Northern pike	Esox lucius	Esocidae	X	X	X	X	X		X	X
ESMA	Maskinongé	Muskellunge	Esox masquinongy	Esocidae	X	X	X	X	X			
ESNI	Brochet maillé	Chain pickerel	Esox niger	Esocidae					X			
ESVE	Brochet vermiculé	Grass pickerel	Esox americanus vermiculatus	Esocidae				X	X			
ETCA	Dard arc-en-ciel	Rainbow darter	Etheostoma caeruleum	Percidae				X	X			
ETEX	Dard à ventre jaune	Iowa darter	Etheostoma exile	Percidae	X			X	X			
ETFL	Dard barré	Fantail darter	Etheostoma flabellare	Percidae			X	X	X		X	
ETNI	Raseux-de-terre noir	Johnny darter	Etheostoma nigrum	Percidae	X	X	X	X	X			X
ETOL	Raseux-de-terre gris	Tesselatted darter	Etheostoma olmstedi	Percidae				X	X			
EXMA	Bec-de-lièvre	Cutlip minnow	Exoglossum maxillingua	Cyprinidae			X	X	X	X	X	
FUDI	Fondule barré	Banded killifish	Fundulus diaphanus	Fundulidae	X	X	X	X	X			X
GAAC	Épinoche à trois épines	Threespine stickleback	Gasterosteus aculeatus	Gasterosteidae					X			
HITE	Laquaiche argentée	Mooneye	Hiodon tergisus	Hiodontidae					X			
HYRE	Méné d'argent	Eastern silvery minnow	Hybognathus regius	Cyprinidae		X		X	X			
ICFO	Lamproie du Nord	Northern brook lamprey	Ichthyomyzon fossor	Petromyzontidae								
ICPU	Barbue de rivière	Channel catfish	Ictalurus punctatus	Ictaluridae		X		X	X			
ICUN	Lamproie argentée	Silver lamprey	Ichthyomyzon unicuspis	Petromyzontidae	X			X	X			
LASI	Crayon-d'argent	Brook silverside	Labidesthes sicculus	Atherinidae				X	X			
LEGI	Crapet soleil	Pumpkinseed sunfish	Lepomis gibbosus	Centrarchidae	X	X	X	X	X	X	X	X
LEMA	Crapet arlequin	Bluegill	Lepomis macrochirus	Centrarchidae					X			
LEME	Crapet à longues oreilles	Longear sunfish	Lepomis megalotis	Centrarchidae					X			
LEPE	Crapet du Nord	Northern Sunfish	Lepomis peltastes	Centrarchidae								
LEOS	Lépisosté osseux	Longnose gar	Lepisosteus osseus	Lepisosteidae				X	X			
LOLO	Lotte	Burbot	Lota lota	Lottidae				X	X	X		X
LUCO	Méné à nageoires rouges	Common shiner	Luxilus cornutus	Cyprinidae	X	X	X	X	X			X
MAMA	Mulet perlé	Pearl dace	Margariscus margarita	Cyprinidae		X			X			
MIDO	Achigan à petite bouche	Smallmouth bass	Micropterus dolomieu	Centrarchidae	X	X	X	X	X	X		X
MISA	Achigan à grande bouche	Largemouth bass	Micropterus salmoides	Centrarchidae	X	X	X	X	X		X	X
MOAM	Baret	White perch	Morone americana	Moronidae	X	X	X	X				
MOAN	Chevalier blanc	Silver redhorse	Moxostoma anisurum	Catostomidae					X			X
MOCA	Chevalier de rivière	River redhorse	Moxostoma carinatum	Catostomidae					X			X
MOCH	Bar blanc	White bass	Morone chrysops	Moronidae				X				
MOHU	Chevalier cuivré	Copper redhorse	Moxostoma hubbsi	Catostomidae					X			
MOMA	Chevalier rouge	Shorthead redhorse	Moxostoma macrolepidotum	Catostomidae					X	X		
MOSA	Bar rayé	Striped bass	Morone saxatilis	Moronidae				X			X	
MOVA	Chevalier jaune	Greater redhorse	Moxostoma valenciennesi	Catostomidae					X			X
NEME	Gobie à taches noires	Round goby	Neogobius melanostomus	Gobiidae						X	X	X
NOAT	Méné émeraude	Emerald shiner	Notropis atherinoides	Cyprinidae		X	X	X	X			
NOBI	Méné d'herbe	Bridle shiner	Notropis bifrenatus	Cyprinidae				X	X			
NOCR	Méné jaune	Golden shiner	Notemigonus crysoleucas	Cyprinidae		X	X	X	X			X
NOFL	Chat-fou des rapides	Stonecat	Noturus flavus	Ictaluridae				X	X			
NOGY	Chat-fou brun	Tadpole madtom	Noturus gyrinus	Ictaluridae		X		X	X			
NOHD	Menton noir	Blackshin shiner	Notropis heterodon	Cyprinidae			X	X	X			X
NOHL	Museau noir	Blacknose shiner	Notropis heterolepis	Cyprinidae				X	X			X
NOHU	Queue à tache noire	Spottail shiner	Notropis hudsonius	Cyprinidae	X	X	X	X	X			
NORU	Tête rose	Rosyface shiner	Notropis rubellus	Cyprinidae		X		X	X			
NOST	Méné paille	Sand shiner	Notropis stramineus	Cyprinidae				X	X			
NOVO	Méné pâle	Mimic shiner	Notropis volucellus	Cyprinidae		X	X	X	X			
ONCL	Truite fardée	Cutthroat trout	Oncorhynchus clarkii	Salmonidae			X		X			
ONKI	Saumon coho	Coho salmon	Oncorhynchus kisutch	Salmonidae			X	X	X			
ONMY	Truite arc-en-ciel	Rainbow trout	Oncorhynchus mykiss	Salmonidae	X	X	X	X	X			
ONTS	Saumon chinook	Chinook salmon	Oncorhynchus tshawytscha	Salmonidae					X			
OSMO	Éperlan arc-en-ciel	Rainbow smelt	Osmerus mordax	Osmeridae		X	X	X	X			
PECA	Fouille-roche zébré	Logperch	Percina caprodes	Percidae	X	X	X		X	X	X	X
PECO	Fouille-roche gris	Channel darter	Percina copelandi	Percidae				X	X			
PEFL	Perchaude	Yellow perch	Perca flavescens	Percidae	X	X	X	X	X	X		
PEMA	Lamproie marine	Sea lamprey	Petromyzon marinus	Petromyzontidae				X	X			
PEOM	Omisco (perche-truite)	Trout-perch	Percopsis omiscomaycus	Percopsidae				X	X			
PHEO	Ventre rouge du nord	Northern redbelly dace	Phoxinus eos	Cyprinidae				X	X			X
PHNE	Ventre citron	Finescale dace	Phoxinus neogaeus	Cyprinidae								X
PINO	Méné à museau arrondi	Bluntnose minnow	Pimephales notatus	Cyprinidae	X	X	X	X	X		X	
PIPR	Tête-de-boule	Fathead minow	Pimephales promelas	Cyprinidae		X		X	X			X
PONI	Marigane noire	Black crappie	Pomoxis nigromaculatus	Centrarchidae	X	X		X	X			
RHAT	Naseux noir	Blacknose dace	Rhinichthys atratulus	Cyprinidae				X	X			
RHCA	Naseux des rapides	Longnose dace	Rhinichthys cataractae	Cyprinidae	X		X	X	X		X	X
SACA	Doré noir	Sauger	Sander canadensis	Percidae	X	X	X	X	X	X		
SAFO	Omble de fontaine	Brook trout (brook char)	Salvelinus fontinalis	Salmonidae			X	X	X			
SANA	Touladi	Lake trout	Salvelinus namaycush	Salmonidae				X	X			
SAOQ	Omble chevalier oquassa	Landlocked Arctic char	Salvelinus alpinus oquassa	Salmonidae					X			
SASA	Saumon atlantique	Atlantic salmon	Salmo salar	Salmonidae					X			
SATR	Truite brune	Brown trout	Salmo trutta	Salmonidae	X	X	X	X	X			
SAVI	Doré jaune	Walleye	Sander vitreus	Percidae	X	X	X	X	X	X		
SEAT	Mulet à cornes	Creek chub	Semotilus atromaculatus	Cyprinidae			X	X	X			X
SECO	Ouitouche	Fallfish	Semotilus corporalis	Cyprinidae			X	X	X		X	X
UMLI	Umbre de vase	Central mudminnow	Umbra limi	Umbridae	X			X	X			X

[1] Four-letter code according to the *SFA, 2011 (Service de la faune aquatique (2011). Guide de normalisation des méthodes d'inventaire ichtyologique en eaux intérieures, Tome I, Acquisition de données, ministère des Ressources naturelles et de la Faune, Québec, 137 p.)*

² Source: Ministère des Forêts, de la Faune et des Parcs du Québec. 2015. Database of experimental fishing results – "Fishing records" – Data from 1928 to 2016.

* Honoré-Mercier Bridge, 138 drainage stream and Little Suzanne creek

Adapted from Dessau-CIMA+ (2013) and Aecom (2017)

3.2.2.1.4.2.2 Site condition when jetties are present – PTA

In 2018, the navigation channel was not part of the additional characterization of the Lesser La Prairie Basin. As stated above, the Lesser La Prairie Basin is a lentic flow zone (Map 7). It mainly contains fine and slightly coarse substrate in some areas. The transects that were characterized in 2018 were all conducted in shallow water (0.6 to 2.2 m). The water in the Lesser La Prairie Basin is slightly cloudier than in the Greater La Prairie Basin. The habitats found in the Lesser Basin are types 4, 5, 8 and 9. Sensitive habitats 4 and 8 are characterized by aquatic plant cover over more than 25% of their surface area and are considered aquatic plant communities. The aquatic plant communities identified in 2012 (16,570 m²) have expanded and now occupy a surface area of roughly 84,850 m². Since the flow in the Lesser La Prairie Basin is lentic in the summer, it is unlikely that the presence of the jetty contributed to the growth of the aquatic plant communities in this area. Under these conditions, the presence of the jetty could locally modify the flow in the spring, thus making conditions more suitable to the development of aquatic vegetation in the area.

The habitats encountered in these plant communities (4 and 8) are suitable for the reproduction of several phytolithophilous species such as bass, perch and some members of the carp family, as well as phytophilous species such as Esocidae (pike and muskellunge). This is also a quality feeding habitat for several species.

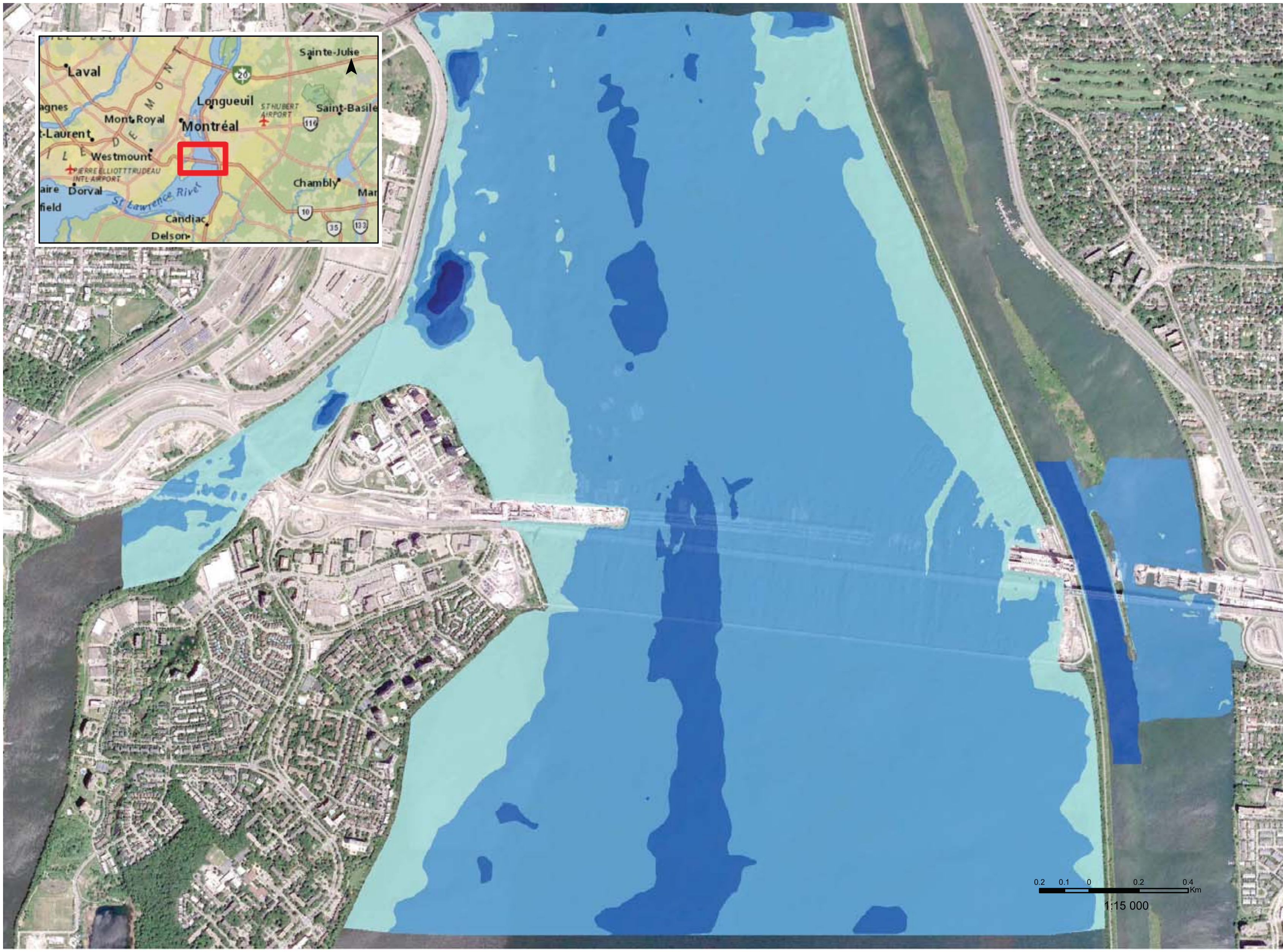
3.2.2.1.4.3 Fish habitat – Greater La Prairie Basin

The Greater La Prairie Basin can be divided into two separate sections, i.e. the channel between the Island of Montreal and Nuns' Island, and the main stem of the St. Lawrence. The Nuns' Island channel was only characterized in 2012. The different types of habitat characterized in the Greater La Prairie Basin in 2012 and 2018 are found on Map 9.

3.2.2.1.4.3.1 Baseline condition prior to the creation of the jetties – Dessau-CIMA+

The Greater La Prairie Basin, including the channel between Nuns' Island and the Island of Montreal, hosts 33 species from 15 families (Armellin *et al.*, 1997; see Table 29). The most representative families are the Percidae, followed by the Cyprinidae and the Centrarchidae. Lake Sturgeon and American Eel are both likely to be designated threatened or vulnerable at the provincial level (see Table 29).

About 50% of the Greater La Prairie Basin is made up of coarse substrate and has no vegetation, just like the middle section extending under the Existing Champlain Bridge (Map 4). The depth of this section, which presents a laminar water flow pattern, ranges from 2 m to 15 m (types 17 and 20). Two main sections alongside Nuns' Island are noteworthy. The combination of coarse substrate, a depth of less than 3 m and the fast-flowing cross current has created two zones, the first, comprising approximately 69,740 m², downstream from the Clément Bridge, and the second, 28,180 m², downstream from the Existing Champlain Bridge (type 22), both with favourable spawning conditions for several fast-flowing water lithophilous species such as Walleye and Catostomidae.



Ponts JACQUES CARTIER + CHAMPLAIN Bridges
Canada

Depth (m)

- 0 - 2
- 2 - 5
- 5 - 15
- 15 and over

DECONSTRUCTION OF EXISTING
CHAMPLAIN BRIDGE (2017-2022)
CONTRACT No. 62555
TARGETED ENVIRONMENTAL ANALYSIS

Bathymetry

March 2019
Coordinate system: NAD83 MTM 8
Base map: Google 2018
Bathymetric surveys

Parsons
Tetra Tech
Amec Foster Wheeler

Map 7

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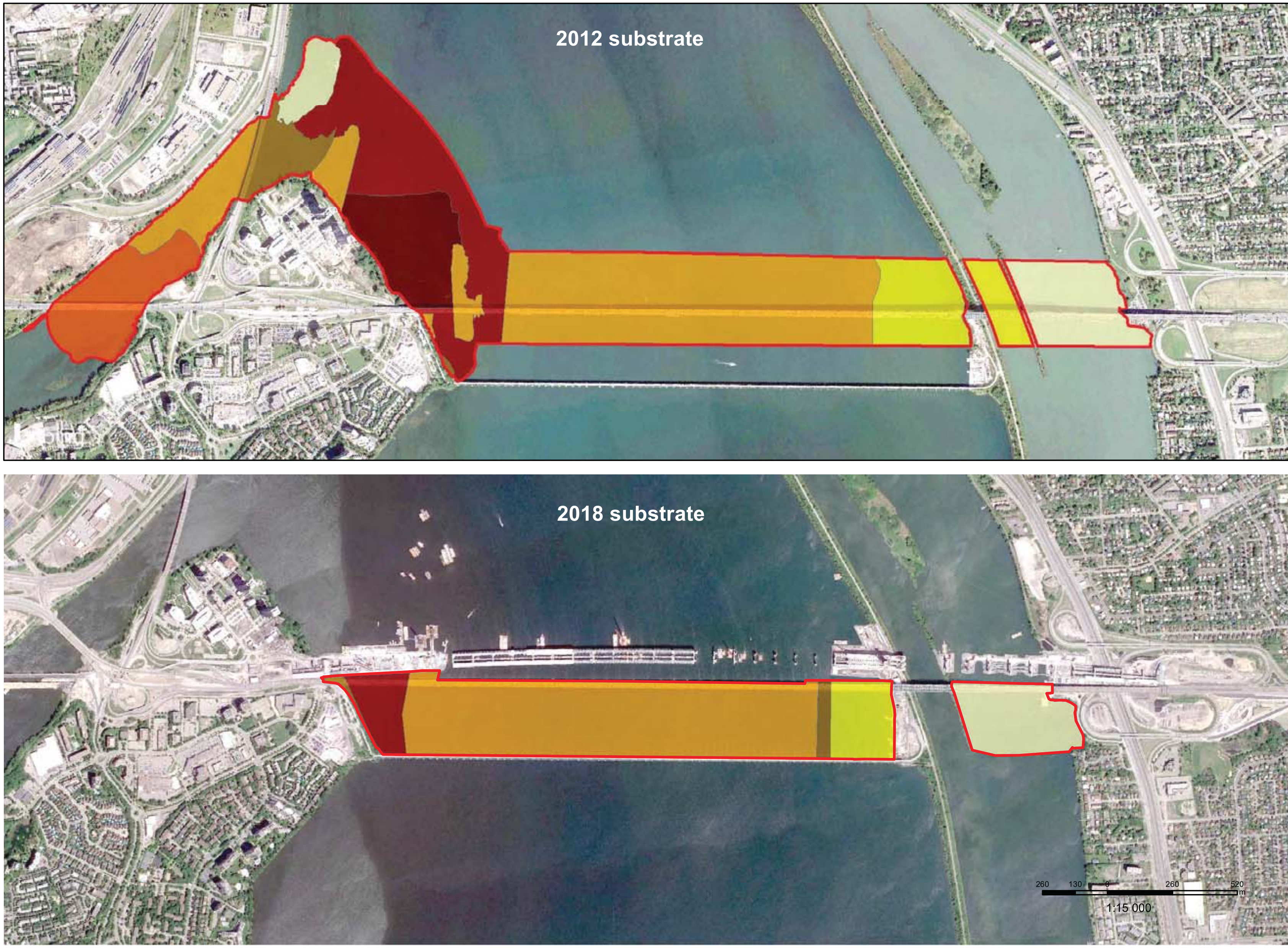

Study area

Substrate

- Organic – Sand
- Pebbles – Gravel
- Cobbles – Blocks
- Cobbles – Blocks – Inflow of sand
- Pebbles – Cobbles
- Block – Sedimentary rock
- Sedimentary rock

DECONSTRUCTION OF EXISTING CHAMPLAIN BRIDGE (2017-2022)
CONTRACT No. 62555
TARGETED ENVIRONMENTAL ANALYSIS

Substrate from 2012 and 2018

March 2019

Coordinate system: NAD83 MTM 8

Base map: Google 2012 and 2018

Map 8

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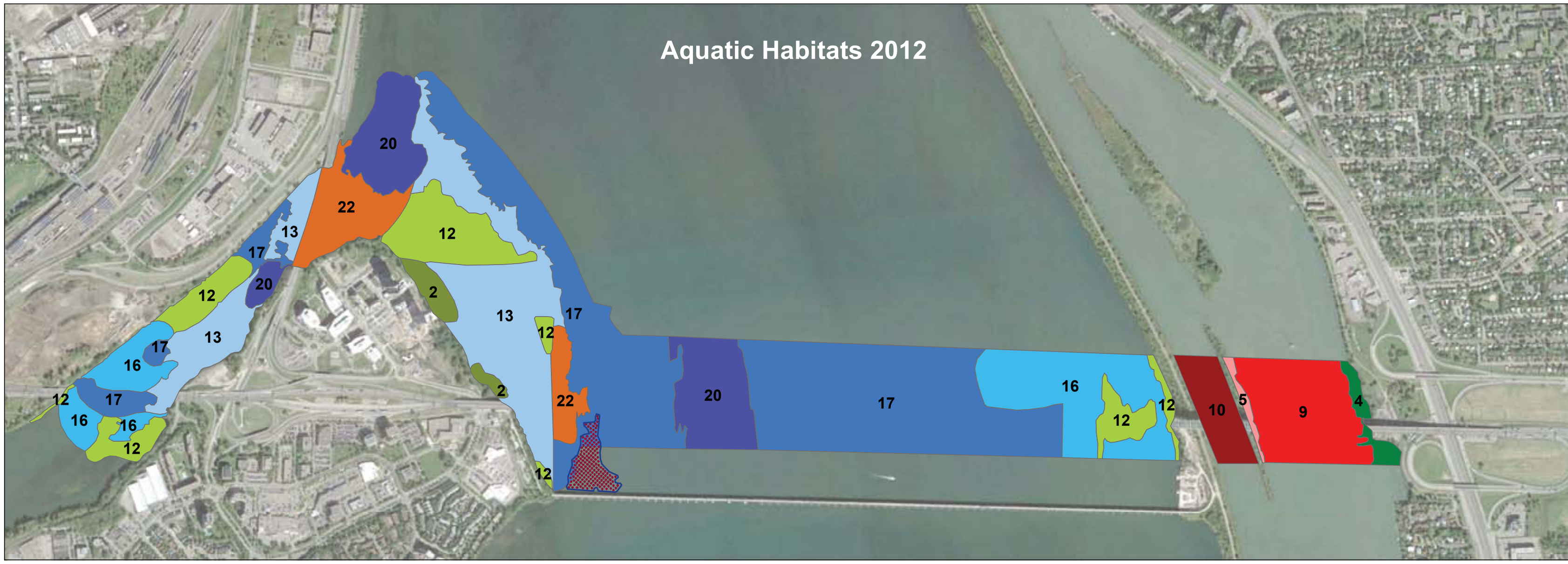
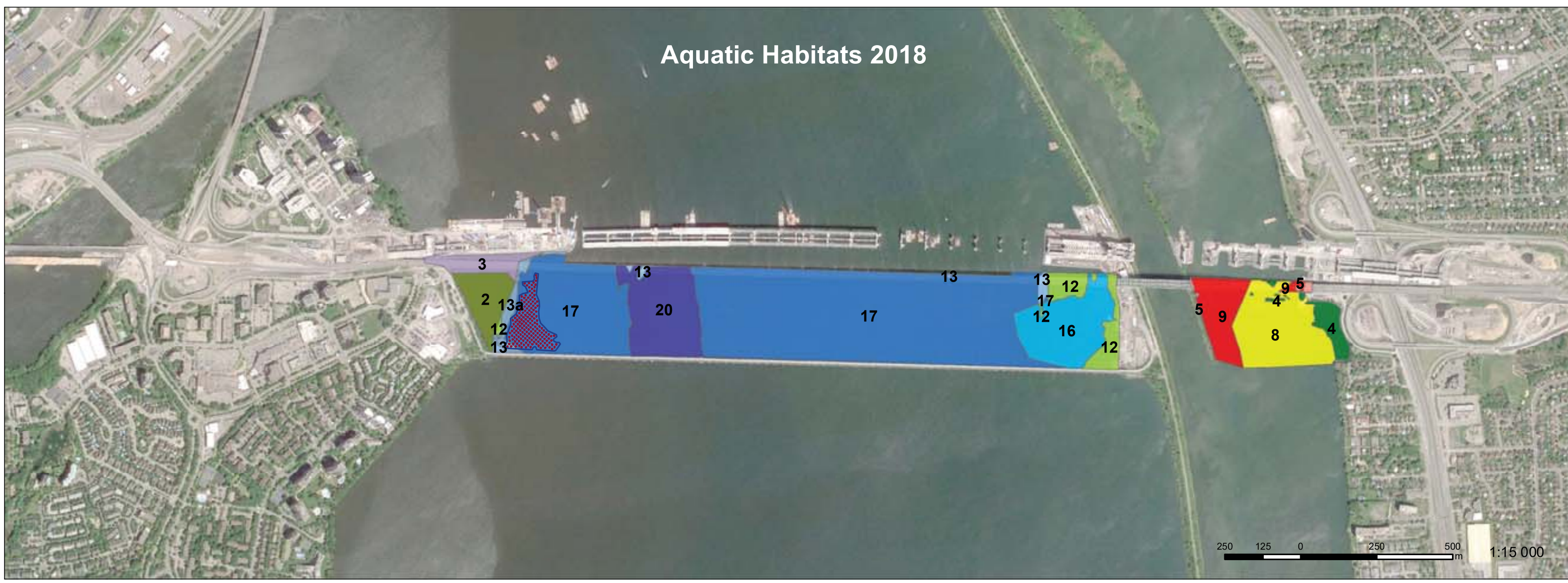
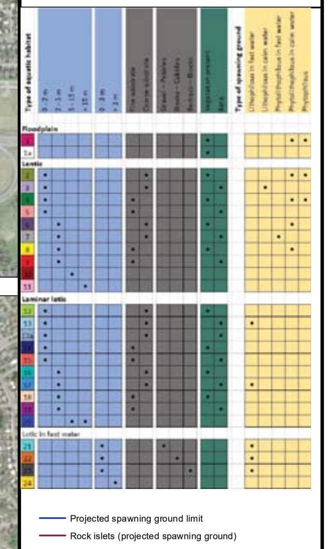






Ponts Jacques Cartier + Champlain Bridges

DECONSTRUCTION OF ORIGINAL CHAMPLAIN BRIDGE (2017-2022)
CONTRACT No. 62555
MONTREAL, QUEBEC

2012 and 2018 Aquatic Inventories

Characteristics of Aquatic Habitats

oct. 2019

Coordinate system: NAD 1983 MTM 8

Base map: Imagery from Google 2012 and 2018

Parsons Tetra Tech Amec Foster Wheeler

Map 9

There are also several areas of aquatic plant communities in the Greater La Prairie Basin, including on the South Shore, with a plant bed of approximately 178,360 m² (types 12 and 16). The channel between Nuns' Island and Montreal contains a variety of intermingled habitats (types 12-13-16-17), of varying depths (0 to 5 m) and vegetation density. This diversity has created a favourable feeding area for several species of fish. Other plant bed areas, where the current is slower (type 2), are found along Nuns' Island and serve as refuge, feeding areas and even spawning grounds for some phytolithophilous species. Two especially deep areas (type 20) were also observed, one along the Island of Montreal and the other one, smaller, along the north shore of Nuns' Island. These depressions were probably created artificially during the construction of road infrastructures.

3.2.2.1.4.3.2 Site condition when jetties are present – PTA

The SSL jetty on the eastern side of Nuns' Island has an impact on the water flow in this area (see Map 9). In fact, before it was created, current speeds were greater and there was only a little vegetation near the shore. Now there is a lentic flow where there was previously fast-flowing water. In fact, the type 22 habitat, a site suitable for the spawning of lithophilous species in fast water, has temporarily disappeared. The low water flow in this area appears beneficial for aquatic vegetation, which now covers about 27,270 m² (Photo 13).

The type of habitat is mainly type 2. In 2012, only 2,000 m² of type 12 habitat was found near the Ice Control Structure in this area. The plant bed that has developed begins just upstream of the Existing Bridge. Type 2 and 12 sensitive habitats temporarily provide a potential spawning ground for phytolithophilous and phytophilous species. At that location, a slight build-up of sediment can be noted on the coarse substrate in the type 3 habitat (reproductive potential for lithophilous species in slow water) that is currently found now that there is a jetty.

Photo 13 – Aquatic plant community on the left shore of the Greater La Prairie Basin (type 2 habitat)

No lotic flow of fast water was observed in the study area during the 2018 characterization campaign. This type of flow was only observed on occasion at the end of the Nuns' Island jetty (SSL west jetty), where a significant increase in current is noted. A turbulence effect was also found behind certain piers of the Existing Champlain Bridge in the middle of the Greater La Prairie Basin (Photo 14).

Photo 14 – Turbulence behind a Champlain Bridge pier

On the shore, the aquatic plant community (type 12 and 16 habitats) south of the Existing Champlain Bridge decreased in size in 2018 compared to 2012. A slightly higher water level and faster currents off the jetty likely contributed to a localized receding of aquatic vegetation. At the end of the work, jetty removal in this area should restore the flow conditions and water levels that were found before work was begun. The aquatic plant communities should then be restored.

In short, after the jetties were created, a temporary loss of sensitive habitat was noted on the east shore of Nuns' Island (type 22) in favour of another sensitive habitat (type 2), and slight receding of the vegetation on the right shore of the Greater La Prairie Basin (type 16 habitat).

3.2.2.1.4.3.3 SSL development of fish habitat

Although this habitat was not present during the 2018 characterization, SSL intends to carry out fish habitat work in 2019 or 2020 to expand a potential spawning ground next to habitat 22 (characterized in 2012). This roughly 2-ha spawning ground in fast-flowing water will be created downstream of the existing Champlain Bridge Ice Control Structure on the left shore, and will be located just upstream of the proposed jetty on the Nuns' Island side.

It will consist in spreading about 500 mm of substrate on the bottom suitable for lithophilous species in fast water (e.g. rounded pebbles measuring 80-200 mm). A large number of islands (187) of three blocks (800-1000 mm) will be spread out across the spawning substrate to create shelter for fish. A plan view of the work is presented in section 6.3.1.4.1 in Volume 2.

The new spawning ground that will be developed in the near future is already now considered a sensitive habitat.

3.2.2.1.4.4 Upstream section

The Lake St. Louis area is located upstream of the study area and comprises several habitat types, including fast-flowing water and calm water areas, islands, and large, shallow areas (3 m deep on average). Large aquatic plant communities and swamps are found that provide a habitat for a multitude of wildlife species. The water flow comes from both the St. Lawrence and the Ottawa River. A total of 76 fish species from 23 families were counted, mainly Cyprinidae, Percidae and Catostomidae (Armellin *et al.*, 1994).

3.2.2.1.4.5 Downstream section

Located in the most urbanized part of the river, the downstream section of the study area experienced considerable stresses (e.g. dredging, filling) due to Montreal's urbanization, expansion of the port and construction of the many bridges linking Montreal to the South Shore. However, this section still contains areas of special interest for wildlife, particularly in the Boucherville Islands archipelago. Moreover, several of these islands are part of a conservation zone and include most of the area's significant habitats, such as aquatic plant communities, marshes and swamps. There are 95 fish species from 24 families in this area (Armellin *et al.*, 1995).

3.2.2.1.4.6 Breeding habitat

Aecom submitted a request for information to the CDPNQ in 2016 (2017). All the documents related to the CDPNQ's response are found in Appendix 8. The CDPNQ identified 12 separate spawning grounds within an 8-km radius of the Existing Champlain Bridge. Table 30 summarizes the CDPNQ information for these 12 habitats. Three of these habitats are found in the study area.

The first habitat (no. 52 on the CDPNQ map) is adjacent to the Brossard shore in the Lesser La Prairie Basin. The portion of habitat that is in the study area is a type 4 habitat, i.e. a shallow aquatic plant community with a lentic flow and fine substrate. This section provides a spawning habitat for phytophilous and phytolithophilous species.

The second habitat (no. 170 on the CDPNQ map) is located on the east bank of a dike separating the Seaway from the Lesser La Prairie Basin. The type of habitat is type 5 and type 9, i.e. a lentic flow zone with fine substrate, ranging from shallow to moderately deep, without any vegetation. Aecom identified this area as a feeding zone only. The characteristics of this spawning habitat identified by the CDPNQ make the spawning potential for most of the species occurring in the area rather low.

The third habitat – no. 196 on the CDPNQ map – covers the north and northeast shores of Nuns' Island up to the Ice Control Structure. The area has fast-moving water (habitat 22), laminar currents (habitats 12 and 13) and lentic currents (habitat 2), and could serve as a spawning, rearing and feeding site for species part of various reproductive guilds (lithophilous (habitats 13 and 22), phytolithophilous (habitat 12) and phytophilous (habitat 4)).

Table 30 – Summary of fish breeding habitats near Champlain Bridge

BREEDING HABITAT	SPAWNING	REARING	FEEDING	OCCURRENCE
Habitat in the study area				
53	*Johnny Darter, Arctic Char, Banded Killifish, Mooneye*	---	---	*Pumpkinseed, Rock Bass, Yellow Perch, Golden Shiner, Alewife*
170	---	---	*Northern Sucker, Arctic Char, Pumpkinseed, Yellow Perch, Rock Bass, Golden Shiner, Banded Killifish*	---
195	---	---	---	*Johnny Darter, Rock Bass, Muskellunge*
Habitat within an 8-km radius of the study area				
52	---	---	---	*Johnny Darter, Pumpkinseed, Yellow Perch, Rock Bass, Golden Shiner, Banded Killifish*
138	---	---	*Northern Pike, Northern Sucker, Pumpkinseed, Rock Bass, Yellow Perch, Golden Shiner, Banded Killifish*	---
138	---	---	*Northern Pike, Johnny Darter, White Sucker, Rock Bass, Yellow Perch, Muskellunge*	---
169	---	---	*Johnny Darter, Black Bullhead, Banded Killifish, Bluntnose Minnow*	---
171	*Johnny Darter, Smallmouth Bass, White Sucker, Rock Bass, Logperch, Largemouth Bass*			---
194	*Rock Bass, Muskellunge, Splitnose Rockfish, Johnny Darter*	---	---	---
194	---	*Cyprinidae, chubs*	---	*Johnny Darter, White Sucker, Rock Bass, Pumpkinseed, Splitnose Rockfish*
218	*Smallmouth Bass*	---	---	---
433	---	---	*Rock Bass, Yellow Perch, Pumpkinseed, Alewife, Arctic Char, Golden Shiner, Mimic Shiner, Bluntnose Minnow, Banded Killifish*	---

Adapted from CDPNQ, 2016.

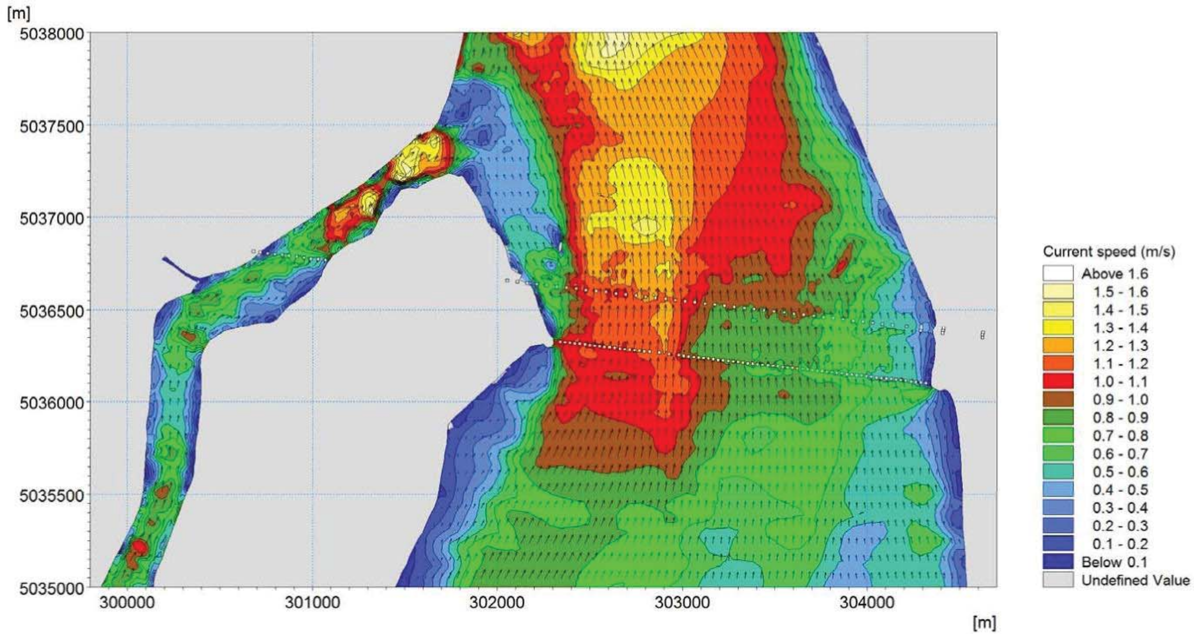
In addition to the spawning grounds identified by the CDPNQ, Aecom (2017) identified a suitable spawning area for Smallmouth Bass, Rock Bass and White Sucker in the channel between the Island of Montreal and Nuns' Island northeast of the causeway-bridge. Young-of-the-year from these three species were in fact caught in this area by Aecom in 2016. Note that this spawning ground is located outside the area of influence of deconstruction work on the Existing Champlain Bridge.

3.2.2.1.4.7 Migratory movements

Breeding sites in fast-flowing water are found in the study area as well as upstream in the Lachine Rapids and near the Mercier Bridge (La Haye *et al.*, 2003). Lithophilous species in the study area and upstream (Table 28) tend to make seasonal migrations to these spawning grounds. Species that spawn upstream of the study area include Lake Sturgeon, with a spawning ground in the Mercier Bridge area (La Haye *et al.*, 2003) and American Shad, with one of two spawning sites in the area located downstream of Carillon in the Ottawa River (Robitaille *et al.,* 2008). The American Eel also migrates through the study area, with juveniles heading upstream and adults downstream (COSEWIC, 2012a).

Although the upstream migration paths are not known in the study area, fish migrating upstream usually take routes where flow velocity is low. In the study area, possible migration corridors with low flow are the channel between Nuns' Island and the Island of Montreal, the eastern shore of Nuns' Island, and along the right bank of the Greater La Prairie Basin (see Figure 31). Downstream migrations normally take place in open fast-flowing water.

As part of the construction of the New Champlain Bridge, migration corridors were created directly in the Nuns' Island jetty to reduce the jetty's impact on the migration of the fish in this area. These are about 3 m wide and are found in the jetty, near the shore, in the middle of the jetty and at the end of the jetty.



Source: excerpted from LaSalle, 2014.

Figure 31 – Modelled current speed at a mean annual flow of 8,400 m³/s

3.2.2.1.4.8 Species at risk with a provincial status

Although not all observed in the study area, there are 21 species that could potentially occur in the area with a special status in Quebec or in Canada. Table 31 presents these 21 species and their status. Seven of the 18 species were recently identified in the study area, i.e. since 2011 (CDPNQ, 2016; Dessau-CIMA+, 2013; Aecom, 2017): American Shad, American Eel, Striped Bass, Splitnose Rockfish, Copper Redhorse, Lake Sturgeon and Rosyface Shiner. A brief description of each species is found in sections 3.2.2.1.4.8.1 to 3.2.2.1.8.7.

These seven species are mainly migratory species with a large home range, but their confirmed presence will require compliance with restriction periods for in-water works specific to these species. The restriction periods for in-water works, as presented in section 3.2.2.1.4.1, would be sufficient to protect most of the fish species during their spawning period. Since the free passage of fish will be maintained for the duration of the work, it was deemed necessary to extend the restriction period for in-water works until September 15 in order to cover the migration period of the American eel.

3.2.2.1.4.8.1 American Shad

The American Shad is an anadromous species, meaning that it mainly lives in salt water but travels to fresh water for spawning, which takes place in a water column (pelagic). It generally feeds on plankton at sea, but feeds little or not at all during its spawning migration to fresh water (MFFP, 2010). The major obstacles to breeding for the Shad are the man-made barriers on migration routes such as hydroelectric dams. Two spawning grounds have been confirmed in western Quebec: one downstream of the Carillon Dam on the Ottawa River (upstream of the study area), and one downstream of the Des Prairies River Dam, between Montreal and Laval (Robitaille *et al.*, 2008). Based on this information, the American Shad could be found in the study area during its migration to spawning sites between May and July and during its return to salt water before the end of August.

The presence at several locations of larvae most likely in transit from a hatching site to riverside habitats appears to be an indication of nearby spawning grounds. There are Shad spawning grounds near the outlet of Lac Saint-Pierre, at Batiscan, and in the south channel of Île d'Orléans (Robitaille *et al.*, 2008).

During test fishing by the Ministère de la Faune, des Forêts et des Parcs (MFFP) in 2013, roughly a dozen individuals were caught near the Existing Champlain Bridge. Most of them showed a rather advanced gonad maturity stage. These fish were therefore likely in migration toward one of the previously mentioned spawning grounds. The migration channels planned for the west jetty (Nuns' Island) can be used for the migration of this species.

Table 31 – Status Species and IAS

Species			Family	Habitat	Feeding	Spawning														Provincial status	Federal status	
Common name in French	Common name in English	Scientific name		Preferential		Guild	Habitat	J	F	M	A	M	J	J	A	S	O	N	D	Quebec City	COSEWIC	SARA
Alose savoureuse	American Shad	Alosa sapidissima	Clupeidae	Rivers during spawning, otherwise generally in a marine environment (coastal bays and estuaries).	Feeds mainly on planktonic crustaceans by filtration; sometimes also small fish in small quantities. Lives in schools. During the spawning period, spawners eat little or not at all.	Pelagic	Anadromous. Rivers; rarely or never in lakes. In Quebec, basically in the Montreal area. 0.5 to 3.0 m in depth, at speeds ranging from 0.2 to 1.0 m/s. Substrate made up of sand, gravel or cobble, sometimes even silt and clay (downstream of Carillon generating station in the Ottawa River). Eggs deposited in the water (end of May and June; 12-18°C).					■	■							Vulnerable	Not at risk	No status
Anguille d'Amérique	American Eel	Anguilla rostrata	Anguillidae	Any habitat accessible from the St. Lawrence	Mainly insectivore and piscivorous when it reaches 40 cm (roughly).	Pelagic	Reproduces in the Sargasso Sea (northeast of Bermuda) between February and April		■	■	■									L.D.T.V.*	Special concern	No status
Bar rayé	Striped Bass	Morone saxatilis	Moronidae	Anadromous. Shallow coastal marine waters, brackish estuaries. In rivers (fresh water) at spawning.	Juveniles feed on zooplankton, crustaceans and other invertebrates. Adults feed on fish such as herring, smelt, tomcod and shad.	Lithopelagic	Anadromous. Some spawners overwinter in freshwater and move back upstream to the spawning grounds in the spring. Drop of oil on the eggs enables them to float to feeding areas of future larvae and fry (May-June).					■	■							No status	Endangered	Endangered
Bec-de-lièvre	Cutlip Minnow	Exoglossum maxillingua	Cyprinidae	Warm, clear, fast-moving waters of rivers and streams with a rocky or gravelly bottom, or free of aquatic vegetation and mud.	Feeds on aquatic insect larvae and molluscs.	Lithophilous	Gravelly areas in fast-flowing watercourses. Imposing nest in the gravel (May-July)					■	■	■						No status	Special concern	Special concern
Brochet maillé	Chain Pickerel	Esox niger	Esocidae	Warm water (21 to 30°C), calm, clear and shallow with abundant vegetation. Rivers, lakes, ponds. Sometimes in brackish water in the winter.	Diet mainly consisting of fish (e.g. minnows, sunfish, bullheads, perch). Opportunistic carnivore, also feeds on insects, crayfish, snakes, frogs and mice. During the winter, is active and feeds under the ice.	Phytophilous	Shallow water (1 to 3 m). Flooded banks of rivers, lakes and ponds, bays of lakes and calm river sections. Eggs are diffused and attach to vegetation (April and May)				■	■								L.D.T.V.*	Not at risk	No status
Brochet vermiculé	Grass Pickerel	Esox americanus vermiculatus	Esocidae	Slow-moving watercourse with abundant vegetation on lowlands and sometimes shallow and grassy areas in lakes. Prefers warm waters (~26°C).	Generally piscivore. Also feeds on crayfish and aquatic insects.	Phytophilous	On the flooded banks of watercourses where there is abundant vegetation, in watercourses in cold water (8-12°C). Demersal eggs attach to plants. Spawns in the spring, sometimes in the fall.				■	■						▒	▒	L.D.T.V.*	Special concern	Special concern
Carassin (poisson rouge)	Goldfish	Carassius auratus	Cyprinidae	Ponds, small, shallow warm-water lakes with abundant vegetation and a muddy bottom.	Feeds on plants and insect larvae.	Phytophilous	Grassy, warm and shallow sections. Eggs attach to plants (May-June).					■	■							Potentially invasive species		
Carpe de roseau	Grass Carp	Ctenopharyngodon idella	Cyprinidae	Plant beds in lakes, rivers and ponds. Tolerates a range of temperatures and little oxygen. Channel and deeper zone in the winter.	Mainly herbivore, also feeds on detritus, insects and other invertebrates.	Pelagic	Fast-flowing rivers. Eggs that are slightly heavier than water develop by drifting and suspended by the water's turbulence.					■	■	■						Potentially invasive species		
Chat-fou des rapides	Stonecat	Noturus flavus	Ictaluridae	Shallow rivers and streams (0.5 to 1.5 m) with moderate to swift currents, where the substrate is made up of large blocks, cobbles and gravel. Sometimes in lakes.	Feeds on benthic prey, especially insect larvae and crayfish, as well as small fish and algae.	Phytolithophilous / Speleophilous	In shallow, slow-moving, slightly turbid water over rocky substrate. Nest in gravel between or under blocks. In warm water (23 to 29°C; June-August).						■	■	■					L.D.T.V.*	Not at risk	No status
Chevalier cuivré	Copper Redhorse	Moxostoma hubbsi	Catostomidae	Present in moderately large rivers, with a moderate current and hard bottom.	Diet almost exclusively consisting of molluscs.	Lithophilous	Spawns in fast-flowing, shallow water (0.75 to 2 m) on rocky substrate at a moderate current (June-July).						■	■						Threatened	Endangered	Endangered
Chevalier de rivière	River Redhorse	Moxostoma carinatum	Catostomidae	Fast-moving warm water (>20°C) in medium-sized watercourses. Prefers bottoms without any mud. Sensitive to pollution and mud.	Diet mainly consisting of aquatic insects as well as molluscs and crustaceans.	Lithophilous	Fast-flowing, shallow water in large watercourses over a coarse substrate without any mud or organic matter. Water temperature over 18°C. Spawns after the Silver Redhorse and Shorthead Redhorse (June).						■							Vulnerable	Special concern	Special concern
Crapet à longues oreilles	Longear Sunfish	Lepomis megalotis	Centrarchidae	Grassy areas of small lakes and watercourses with a low or moderate current and clear, warm water. Does not tolerate turbid water.	Aquatic and terrestrial insects	Lithophilous	In shallow parts of ponds, lakes and rivers on a substrate consisting of gravel, sand or mud (June-August; 23-25°C)						■	■	■					No status	Not at risk	No status
Crapet du Nord	Northern sunfish	Lepomis peltastes	Centrarchidae	The species prefers shallow, vegetated areas of warm lakes and ponds and slow-moving streams. Generally in clear water. The substrate of its habitat typically consists of sand and gravel. Considered intolerant to siltation.	Insects caught in the water column, but also small fish and fish eggs.	Lithophilous	In shallow areas with a sandy or gravelly/pebble substrate. Eggs deposited in a saucer-shaped depression dug into the substrate by the male (temperature above 23.3°C).						■	■						L.D.T.V.*	Special concern	Special concern
Dard arc-en-ciel	Rainbow Darter	Etheostoma caeruleum	Percidae	Clear, well-oxygenated, fast-moving streams with a gravelly or rocky bottom.	Mainly feeds on insect larvae.	Phytolithophilous	In shallow water over roots or rocky substrate (May-June; 16-17°C).					■	■							L.D.T.V.*	Not at risk	No status
Dard de sable	Eastern Sand Darter	Ammocrypta pellucida	Percidae	Clear, shallow rivers and streams (<0.5 m) with gentle current (<0.2 m/s). Closely associated with fine sandy substrates, containing more than 90% sand, since it buries in it. Sensitive to silting in streams.	Diet mainly consisting of aquatic insects.	Lithophilous	In shallow rapids with a slow or moderate current, over sand and gravel substrates. When the water temperature is between 15° and 24°C (June-August).						■	■	■					Threatened	Threatened	Threatened
Esturgeon jaune	Lake Sturgeon	Acipenser fulvescens	Acipenseridae	Water 5 to 9 m in depth (sometimes up to 43 m) over a silty bottom or gravel and mud. Highly productive areas of large rivers and lake shoals, occasionally in brackish waters.	Finds food on the bottom using its sensory barbels. Sucks up a large variety of small organisms such as molluscs, aquatic insect larvae, crayfish, leeches, fish eggs and a some plants. Feeds throughout winter, but stops feeding during the spawning run.	Lithopelagic	Fast-moving, shallow water (0.6 to 4.9 m). Mainly in rivers near a natural or artificial barrier that limits fish migration upstream, sometimes in lakes. Does not spawn every year. Diffused eggs attach to rocks and gravel (May-June; 13-18°C).					■	■							L.D.T.V.*	Threatened	No status
Esturgeon noir	Atlantic Sturgeon	Acipenser oxyrinchus	Acipenseridae	Anadromous species found in coastal marine regions and estuaries and spawns in freshwater.	Bottom-feeder; with its four barbels, feeds on crustaceans, worms, insects, molluscs and sometimes fish.	Lithopelagic	Spawns in freshwater over a hard substrate (rock or clay). In pools at the foot of falls of rapids at depths ranging from 1 to 60 m, depending on the spawning ground. Often where there is a fairly strong current. Three known spawning grounds in Quebec: Richelieu rapids, confluence of the Chaudière river and the St. Lawrence, and near St-Antoine-de-Tilly (May-July; 21 to 23°C).					■	■	■						L.D.T.V.*	Threatened	No status
Fouille-roche gris	Channel Darter	Percina copelandi	Percidae	In rivers, lakes or stream pools with little turbidity. Shallow water over a sand and gravel substrate in low current. Does not tolerate pollution.	Aquatic insect larvae and crustaceans, as well as debris and plant material.	Lithophilous	In the gravel often near a rock in a moderate river current. Avoids areas with sediment buildup in the gravel. Competes with other Percidae for spawning grounds (May-July; 20.5-21.2°C).					■	■	■						Vulnerable	Not at risk	Special concern
Gobie à taches noires	Round Goby	Neogobius melanostomus	Gobiidae	Benthic fish on the shores of lakes and rivers with a rocky substrate, in freshwater and sometimes brackish water. Tolerates different depths.	Feeds on insect larvae, fish eggs, zebra mussels and other bivalves.	Lithophilous	Adhesive eggs deposited on a hard substrate. Several spawnings during the breeding season (April-September).				■	■	■	■	■	■				Invasive species of special concern		
Lamproie argentée	Silver Lamprey	Ichthyomyzon unicuspis	Petromyzontidae	Large rivers and lakes. Not found in watercourses used by the American Brook Lamprey or Northern Brook Lamprey . Ammocoete larvae buried in soft bottoms for 4 to 7 years.	Ammocoete larvae: Feeds by plankton filtration. Adults: Ectoparasite that feeds on the blood of several species of fish such as Lake Trout, whitefish, pikes, suckers, redhorses, Muskellunge, sturgeon, bullheads and gars.	Lithophilous	Gravel nest in running water of rivers (May-June; 12-19°C).					■	■							No status	Special concern	Special concern
Lamproie du Nord	Northern brook lamprey	Ichthyomyzon fossor	Petromyzontidae	Creeks and small rivers in shallow water on a substrate of sand and gravel.	Adults do not feed; Amocetes (juveniles) are planctivore.	Lithophilous	In shallow water of small rivers on a substrate of gravel, pebbles and blocks (May-June; 12.8-23.3°C).						■	■						Threatened	Special concern	Special concern
Méné d'herbe	Bridle Shiner	Notropis bifrenatus	Cyprinidae	Grassy riverbanks or lake shores with a muddy or sandy bottom or quiet watercourses. Relatively warm and clear water.	Feeds on small crustaceans, aquatic insects and algae.	Phytophilous	In abundant submerged vegetation. Preference for indigenous water-milfoil stands (May-August)					■	■	■	■					Vulnerable	Special concern	Special concern
Omble chevalier oquassa	Sunapee Trout	Salvelinus alpinus oquassa	Salmonidae	Freshwater populations in cold water in deep lakes.	Carnivorous. Varied diet depending on the availability of prey, including crustaceans, insects and several species of fish. At times cannibalistic.	Lithophilous	Gravel or rocky shoals in lakes; quiet pools (1.0 to 4.5 m) in rivers. Eggs laid in a gravel nest (September and October in the north and November to December in the south).									■	■	■	■	L.D.T.V.*	Not at risk	No status
Tête rose	Rosyface Shiner	Notropis rubellus	Cyprinidae	In the clear, fast-moving waters of small rivers with a gravelly or rocky bottom. Does not tolerate turbidity and silting in streams. Rarely in lakes.	Feeds on aquatic and terrestrial insects as well as plant material.	Lithophilous	In fast-moving water with a gravelly or sandy bottom. Adhesive eggs diffused into spaces in the gravel (May-June).					■	■							L.D.T.V.*	Not at risk	No status
Truite arc-en-ciel	Rainbow Trout	Oncorhynchus mykiss	Salmonidae	Shallow, clear, cool water (<21°C) with a gravel bottom in moderate-current rivers. Moderately deep to deep lakes with vegetation, shoals and tributaries with a gravel bottom.	Mainly bottom feeding, but also surface feeding. Its carnivorous diet varies based on its size and consists of plankton, crustaceans, insects, slugs, leeches, small fish (perch and minnows) and fish eggs.	Lithophilous	Fast-moving watercourses with a fine gravel bottom. Small river tributaries, lake inflows and outflows. Spring (mid April – late June; there are populations that spawn in the fall).				■	■	■			▒	▒			Species requiring special management		

[1] Four-letter code according to the *SFA, 2011 (Service de la faune aquatique (2011). Guide de normalisation des méthodes d'inventaire ichtyologique en eaux intérieures, Tome I, Acquisition de données, ministère des Ressources naturelles et de la Faune, Québec, 137 p.)*

* L.D.T.V.: Likely to be designated threatened or vulnerable

In orange (■): Main spawning period

In dotted orange (▒): Secondary spawning period

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3.2.2.1.4.8.2 American Eel

The American Eel is a catadromous species (i.e. lives in fresh water but reproduces in salt water) and breeds in the Sargasso Sea (COSEWIC, 2012a), travelling upstream as far as the Great Lakes during its growth period. Juveniles migrate upstream throughout the summer and adults migrate downstream mainly from June to October (COSEWIC, 2012a). As eels adapt easily to various habitats and are essentially omnivorous, they could use the study area as both a migration route and a feeding ground. The Existing Champlain Bridge area has potential habitats for the American Eel. The many areas of coarse rock along the banks of the St. Lawrence, including alongside the temporary Ice Control Structures, provide numerous shelters and thus constitute an excellent potential habitat for the eel (Aecom, 2017). Submerged vegetation areas also represent an element of interest for the species.

During fishing conducted by AECOM in 2016, 13 American Eels were caught near the various coarse rock areas along the shores as well as in the watercourse across from the west shore of Nuns' Island. The migration channels planned for the west jetty (Nuns' Island) can be used for the migration of this species.

3.2.2.1.4.8.3 Striped Bass

Striped Bass is an anadromous species, meaning that it matures in salt water but spawns in fresh water. In the fall, adult Striped Bass migrate from the coast to overwinter in the estuaries and fresh-water environments. Spawners then spend the winter in the St. Lawrence and move back upstream to the spawning grounds in the spring (May-June; Scott and Crossman, 1974). Once hatched, the young move to the brackish and salt waters of the estuaries to feed and grow for a few years until maturity. Little information is available on young-of-the-year, but several summer growth areas are found around the St. Lawrence Islands as well as the banks of the St. Lawrence (COSEWIC, 2012b). Immature Striped Bass seem to prefer gravel and sand substrates and locations with at least some current (Scott and Crossman, 1974).

The St. Lawrence's Striped Bass population is noteworthy, since it was considered to have disappeared from the river since the 1960s. This species has been part of a reintroduction program in the St. Lawrence as of 2002. Currently, the Striped Bass population in the St. Lawrence is considered an "endangered species" under the *Species at Risk Act* (SARA) and by COSEWIC (2012b). In 1996, the Quebec government granted the species the official status of extirpated. Currently, the species has no special status at the provincial level.

Striped Bass fishing is prohibited throughout Quebec outside the southern Gaspé peninsula during the authorized fishing period, and any accidental catches must be released live (MFFP, 2018a). However, its range appears to be limited to an estuary and river section of about 300 km between Sorel and Kamouraska. Note that rare individuals were caught in Lake Saint-Louis near Montreal. Since 2002, Striped Bass have been caught between the eastern part of the Island of Montreal and Rimouski, although most of the catches and observations come from the section between Lac Saint-Pierre and Rivière-du-Loup (COSEWIC, 2012b; DFO, 2010; Valiquette *et al.*, 2018).

During inventories carried out in July 2016 by Aecom, a Striped Bass was caught with a gill net in the Lesser La Prairie Basin (Photo 15). The individual, which was about 200 mm long, was at a juvenile stage of development. According to Aecom, the individual in question was a migrating juvenile originating from a spawning ground that was potentially present upstream of the study area and headed to the brackish waters of the estuary to feed and grow before reaching maturity.

Source: Excerpted from Aecom, 2017.

Photo 15 – Striped Bass caught in the Champlain Bridge area

3.2.2.1.4.8.4 Splitnose Rockfish

This small freshwater fish is found in a fairly small area in eastern Ontario and Quebec, where it no longer occurs in two river basins over the last 10 years. Most of the species' current range is affected by the potential impact of the generalized degradation of the habitat and multiple invasive species.

The Splitnose Rockfish prefers the warm, clear, fast-moving waters of rivers and streams with a rocky or gravelly bottom, or that are free of aquatic vegetation and mud. It mainly feeds on aquatic insect larvae and molluscs. This is a lithophilous species that spawns in gravelly areas of fast-flowing watercourses where it builds an imposing nest in the gravel. Spawning occurs from May to July.

3.2.2.1.4.8.5 Copper Redhorse

The Copper Redhorse is on the list of threatened species in the *Act respecting threatened or vulnerable species* (Quebec) and is also listed as endangered in Canada under SARA.

The Copper Redhorse is a species endemic to Quebec. The adult Copper Redhorse mainly uses medium- to high-density grass beds that are rich in gastropods, shallow waters with slow moving currents around the islands and archipelagos of the St. Lawrence and the Richelieu, Des Prairies and Mille Îles rivers (COSEWIC, 2014). The species' survival depends in large part on the availability of submerged grass beds in their range, thus allowing them to feed early on in life. A few grass beds in the study area may be a suitable habitat for the Copper Redhorse. However, no Copper Redhorses were caught by Aecom during the 2016 inventories.

With respect to spawning, no known Copper Redhorse breeding sites occur in the St. Lawrence. The only two known spawning grounds for this species are in the Richelieu River. The first is located in the Chambly rapids archipelago and the second in the channel downstream from the Saint-Ours dam (COSEWIC, 2014).

3.2.2.1.4.8.6 Lake Sturgeon

Lake Sturgeon is a species likely to be designated threatened or vulnerable in Quebec. In Canada, this species is threatened according to COSEWIC (2006), but has no status under SARA.

The Lake Sturgeon's spawning habitat is characterized by shallow fast-flowing water and a coarse substrate made up of blocks and cobbles. In the study area, a type 22 habitat corresponds to the theoretical criteria for the Yellow Sturgeon's spawning habitat. Although this habitat is found in the study area, particularly around the eastern tip of Nuns' Island, the spawning ground for this species has never been confirmed in the Existing Champlain Bridge area (La Haye *et al.*, 2003). Lake Sturgeon spawn around late May and early June in the St. Lawrence (La Haye *et al.*, 2003). The MFFP caught two Lake Sturgeon individuals in the study area in spring 2013 during the species' spawning period (MFFP, 2013 reported in Aecom, 2017). Since these dates are right in the middle of the breeding period, this is an indication that spawning grounds are present in the area or nearby. These sturgeons may simply have been migrating through the study area toward spawning grounds identified upstream of the Champlain Bridge, including the one in the Mercier Bridge area (La Haye *et al.*, 2004).

The sturgeon is a bottom feeder at depths ranging from 5 to 9 m (sometimes deeper) where the substrate is silty. It feeds on a variety of organisms found in the benthos. There is no substrate in the Greater La Prairie Basin specifically suitable to its diet owing to the lack of fine substrate, but the presence of sand throughout the coarse substrate of the Greater La Prairie Basin may allow Lake Sturgeon to feed.

A Lake Sturgeon was observed on August 23, 2012 during the Dessau-CIMA+ surveys near the site downstream of the Existing Champlain Bridge. In 2016, AECOM caught two individuals in the study area. In the Lesser La Prairie Basin, the substrate is more suitable for Lake Sturgeon feeding.

This species overwinters in trenches 8 to 16 m deep, in a current of less than 0.8 m/s (Environnement Illimité, 2003). The two trenches (type 20) upstream and downstream of the Clément Bridge meet these criteria, and could potentially serve as overwintering sites for sturgeon.

3.2.2.1.4.8.7 Rosyface Shiner

The Rosyface Shiner is a cyprinid species likely to be designated threatened or vulnerable in Quebec. It has no special status under federal law.

It is usually found in clear fast-flowing water in small rivers with rocky or gravelly bottoms (Bernatchez and Giroux, 2012). This species does not tolerate turbidity and silting in streams. It feeds on aquatic and terrestrial insects as well as plant material. Some habitats in the Greater La Prairie Basin may be suitable for feeding (types 12 and 16).

It spawns in the spring in fast-moving water with a gravelly or sandy bottom. This species is not very likely to spawn in the study area. Conditions in the Lesser La Prairie Basin are characterized by low flow, with an inadequate substrate and turbidity. The substrate in the Greater La Prairie basin is generally too coarse.

No individuals of this species were caught by Aecom in 2016. The only mention of this species in the study area was in the 2013 EA. The species had been observed by the Dessau-CIMA+ team in the Seaway Canal.

3.2.2.1.4.9 Invasive alien species (IAS)

The MFFP has designated seven species of fish occurring in Quebec as invasive alien species of concern (or of potential concern). Among them, two species of fish (Round Goby and Rainbow Trout) were found in the study area. One species of fish (Asian Carp) is also possibly present in the study area. The following paragraphs provide information on each of these three species.

3.2.2.1.4.9.1 Round Goby

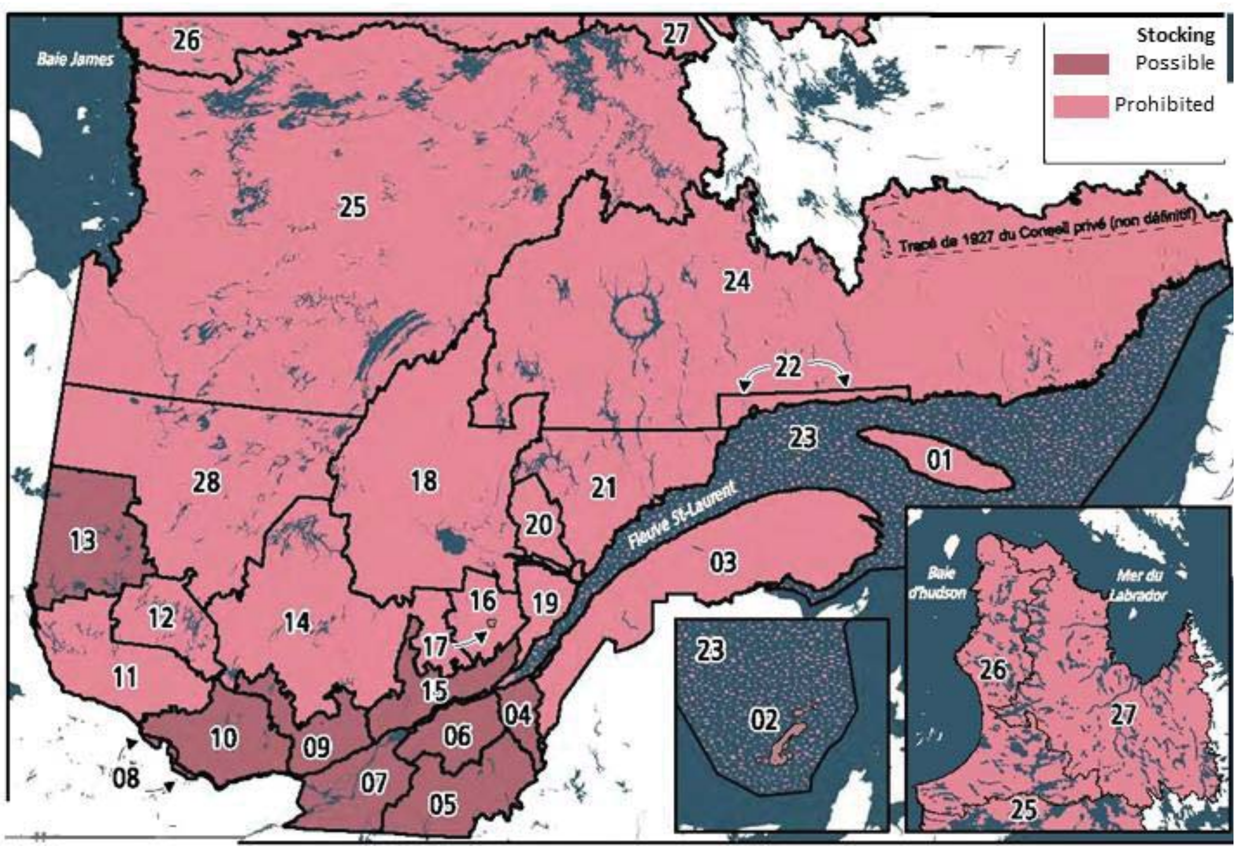
The Round Goby was introduced into the Great Lakes system about 25 years ago and spread through the St. Lawrence River up to Rivière Ouelle, 350 km downstream of the study area. It prefers rocky and sandy substrates and competes with other species due to its aggressive habits and capacity to reproduce several times per season (MFFP, 2018a). The Round Goby can be observed in the study area but prefers the habitats around Nuns' Island and inside the Lesser La Prairie Basin (Aecom, 2017). In 2018, several Round Goby individuals were observed in the Greater La Prairie Basin (Photo 16).

Photo 16 – Round Goby observed in the Greater La Prairie Basin

3.2.2.1.4.9.2 Rainbow Trout

Though considered invasive in several countries, the Rainbow Trout has been present in Quebec since 1893. Since then, this species has been regularly stocked for recreational fishing in the upstream sections of the St. Lawrence. Rainbow Trout can push out native brook trout, and is therefore considered undesirable in areas where Brook Trout is widespread. Because of the migration of Rainbow Trout outside of the Upper St. Lawrence region, in particular toward the salmon rivers in the eastern part of the province, the MFFP has implemented a Rainbow Trout action plan for 2012-2018 to prevent the spread of this species in several areas (MDDEFP, 2013). This action plan has enabled a Rainbow Trout monitoring program to be implemented in eastern Quebec, along with an increase in the allowed bag limit and possession limit.

The area of the Existing Champlain Bridge is found in a sector that allows the stocking of Rainbow Trout (Figure 32).



Source: (excerpted from the MFFP website: https://mffp.gouv.qc.ca/faune/peche/gestion-truite-arc-en-ciel.jsp)

Figure 32 – Aquaculture zoning for Rainbow Trout

3.2.2.1.4.9.3 Asian Carp

According to the MFFP, four species of Asian Carp (Silver, Bighead, Grass and Black) were imported to the U.S. in the 1960s. These species, commonly referred to as "Asian carp," have exceptional features, in particular with respect to their potential size, growth rate, reproduction rate, and considerable migration capacity. After escaping from fish farms, Asian carps invaded the Mississippi River and naturally spread to its watershed. The connection by channels of the Mississippi River with the Great Lakes indicates possible and imminent colonization of the Great Lakes and the St. Lawrence River system.

Since 1985, over 150 Grass Carps have been caught in the Great Lakes. In early 2017, the presence of the Grass Carp in the St. Lawrence River system was confirmed by the MFFP based on one individual that was caught by a commercial fisherman in Contrecœur in May 2016. In addition, deoxyribonucleic acid (DNA) specific to this species was detected in water samples collected in 2015 and 2016. Until now, there have been no indications of the presence of Silver Carp, Bighead Carp or Black Carp. Since a specimen of Grass Carp was caught in the St. Lawrence at Contrecœur, there is a chance that this species could be found in the study area.

3.2.2.1.5 Summary

The fish population in the study area is highly diversified, with 98 species potentially occurring in the area. The fish population is dominated by warmwater species. Most of the species that are known or suspected to be in the area spawn in the spring or early summer. Therefore, this period is considered as being sensitive for the fish in the study area. Moreover, DFO implements a restriction period for in-water works to protect the main species of interest. These restriction periods for in-water works by type of habitat are presented in Volume 2 of the TEA.

The habitats considered sensitive in the study area are types 1, 2, 3, 4, 6, 8, 12, 13, 13a, 14, 16, 18, 21 and 22. Some sensitive habitats were found in the immediate vicinity of the Existing Champlain Bridge in 2012 (types 2, 4, 12, 16 and 22). The presence of jetties locally modified flow conditions favouring the spread of grass beds upstream of the jetties. In 2018, habitat 22 is temporarily non-existent due to the presence of the jetties. It is expected that flow conditions in the area will return to normal following the removal of the jetties, and that habitat 22 will once again be present. Although deconstruction work on the Existing Champlain Bridge will take existing sensitive habitats into account (status of site in 2018), the future SSL fish habitat will also be considered. Special attention must also be paid to the breeding habitats identified in the area by the CDPNQ.

Of the 98 species of fish potentially occurring in the study area, 21 have a provincial or federal conservation status. Seven of these were recently documented in the study area. Although no known spawning habitat for these species has been found in the study area, the restriction period for in-water works must be revised based on the status species occurring in the area.

Two species of fish (Round Goby and Rainbow Trout), whose presence was confirmed in the study area, are considered to be invasive alien species. Asian Carp is also potentially present in the study area. Measures must be implemented to limit the spread of these species during the deconstruction of the Champlain Bridge.

3.2.2.2 Benthic communities

Macroinvertebrates and benthos in bodies of water serve as additional indicators of the latter's health, particularly over the long term. These components of the aquatic environment were never part of a characterization for the Existing Champlain Bridge. For about 10 years, ECCC, the St. Lawrence Action Plan and the MELCC have been conducting joint biomonitoring based on benthic macroinvertebrates from Cornwall to Trois-Rivières, which is part of a national program aimed at assessing the biological health of Canada's freshwater.

An additional survey of these components was therefore conducted in 2018 using a shoreline protocol based on the identification of families similar to the biomonitoring under way along the St. Lawrence. A methodology tailored to this context was set up for deep-water areas, consisting of six stations in the axis of the Existing Bridge. The focus was on areas near the shore, where a survey by fording and snorkeling was conducted in addition to the use of divers, because of the areas' considerable biodiversity. The campaign also included an active search for freshwater mussels in order to confirm the presence of at-risk species.

Because of the strong current, no sampling could be done of the benthic communities at station BS-03.

3.2.2.2.1 Macroinvertebrates

The macroinvertebrate survey was conducted from August 24 to 27, 2018. Appendix 9 presents the entire methodology for the survey.

3.2.2.2.1.1 Results

3.2.2.2.1.1.1 Shoreline stations

No live mussels were observed at the stations and only old shells from three species were found (Table 32). These are considered common (Desroches and Picard, 2013). The potential presence of live mussels is low, and the presence of at-risk species is virtually nil.

In addition, both stations revealed an abundance of empty shells of the Great Lakes Horn Snail (*Goniobasis livescens)*. A single (dead) crayfish was observed: exuviae of the Virile Crayfish (*Orconectes virilis*). These two species are typically found in the St. Lawrence River (Dubé and Desroches, 2007; Clarke, 1981).

Table 32 – Freshwater mussels observed at the shoreline stations

SPECIES		STATION BS-01			STATION BS-02			TOTAL
COMMON NAME	LATIN NAME	LIVE FRESHWATER MUSSEL	RECENT SHELL	OLD SHELL	LIVE FRESHWATER MUSSEL	RECENT SHELL	OLD SHELL	
Eastern Elliptio	*Elliptio complanata*	0	0	2	0	0	2	4
Eastern Lampmussel	*Lampsilis radiata*	0	0	0	0	0	1	1
Plain Pocketbook	*Lampsilis cardium*	0	0	0	0	0	1	1
Total	—	0	0	2	0	0	4	6

3.2.2.2.1.1.2 Deep-water transects

A low abundance of freshwater mussels was observed in deep-water areas, likely because of high current, substrate that is often too coarse, and generally unsuitable habitats. Only transect O (Map 6) revealed an abundance of live mussels and empty shells. Moreover, more than half of the live mussels came from this transect. A total of 12 live mussels were observed and at least 31 empty shells. Most of the mussels were not identified because of poor visibility in the water when the videos were made. Most of the mussels identified in deep water consisted of Eastern Elliptio (*Elliptio complanata*) and Eastern Lampmussel (*Lampsilis radiata*). In addition, a likely recent half shell from what appears to be a Hickorynut (*Obovaria olivaria*) was observed in transect E, as shown on the screen shot in Photo 17. This species is listed as endangered by the SARA (Government of Canada, 2019) and the COSEWIC (COSEWIC, 2011) and likely to be designated threatened or vulnerable in Quebec (MFFP, 2018c).

However, no live specimen that could be related to this species was sighted, and it is highly likely that the shell was transported by the current from upstream. Freshwater mussels are obligate parasites of larval fish, and Lake Sturgeon (*Acipenser fulvescens*) is the suspected host fish of the Hickorynut (Desroches and Picard, 2013).

Based on our observation, the two species should thus likely be found in the upstream part of transect E. Although populations may be present upstream, the likelihood of the presence of populations in the study area is considered small.

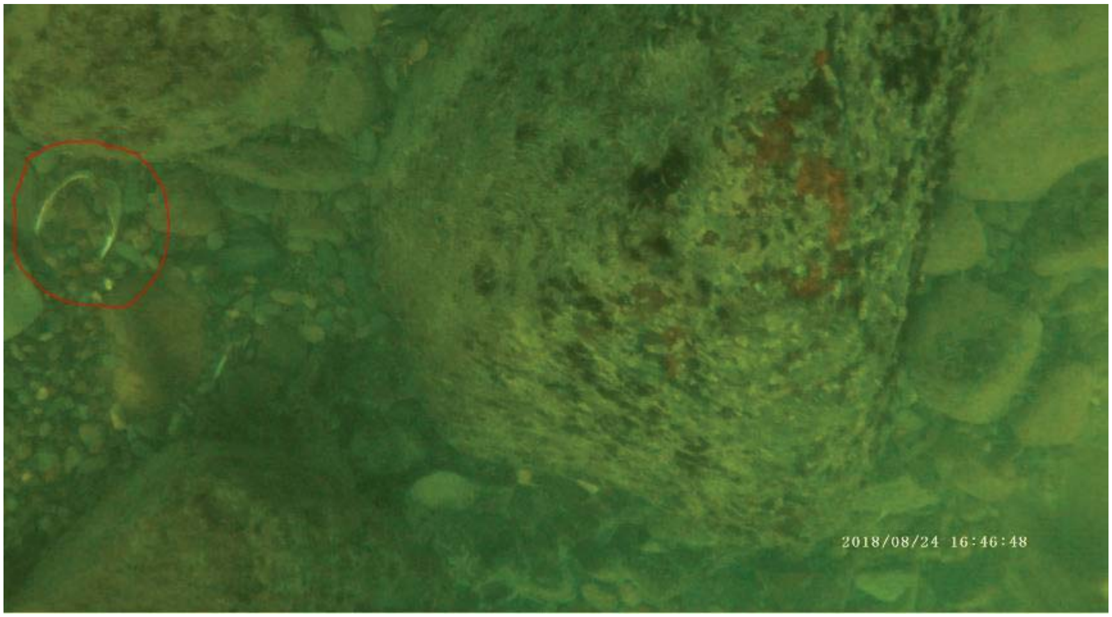


Photo 17 – Snapshot of the presumed shell of *Obovaria olivaria* observed in transect E

A few other mollusc shells were found in the transects. At least one live Quagga Mussel (*Dreissena bugensis*) in transect B and several empty shells of the Zebra Mussel (*Dreissena polymorpha*) were identified in several transects. In addition, numerous empty shells of aquatic gastropods were sighted, but these were difficult to identify given the quality of the videos. Physa (*Physa sp.*), pleurocids (probably *Pleurocera acuta* and *Goniobasis livescens*) and Lymnaeidae (unidentified) were still found. Lastly, no crayfish were observed on the videos in deep-water areas. Table 3 in Appendix 9 summarizes the observations.

3.2.2.2.1.2 Status species

Two status species of freshwater mussels were identified by the CDPNQ, both from the same family of Unionidae: the Elephantear and the Spike (CDPNQ, 2016). These two species of freshwater mussels are likely to be designated as threatened or vulnerable at the provincial level.

Four other species of freshwater mussels potentially occurring in the area are likely to be designated as threatened or vulnerable at the provincial level. They are the Alewife Floater, the Fragile Papershell, the Pink Heelsplitter and the Hickorynut. The latter is also considered endangered in Schedule 1 of SARA . All of the above freshwater mussels are potentially occurring in the study area, despite the fact that no living individual was observed during the August 2018 sampling campaign (see section 3.2.2.2.1 – Macroinvertebrates).

The introduction of invasive alien species such as Zebra Mussels and Quagga Mussels has a direct impact on the populations of indigenous freshwater mussels. These two species of invasive mussels are major competitors for available resources and sometimes attach to the shells of the other mussels by the hundreds, thus preventing them from feeding, breathing, moving and reproducing (DFO, 2014). Habitat fractioning (e.g. due to dams) and agricultural and industrial pollution also threaten some species of freshwater mussels.

3.2.2.2.1.3 Invasive alien species (IAS)

The MFFP has designated four species of molluscs occurring in Quebec as invasive alien species of concern (or of potential concern). Among them, one species of mollusc (Zebra Mussel) was found in the study area. Two species of mollusc (Chinese Mystery Snail and Quagga Mussel) are also potentially present in the study area. The following paragraphs provide information on each of these species.

3.2.2.2.1.3.1 Zebra Mussel

The Zebra Mussel was observed for the first time in Ontario in 1988, then in the St. Lawrence in 1990. It can attach to various substrates and thus become highly prolific. The Zebra Mussel has had an impact on various types of infrastructures and on native populations of freshwater mussels. Because of its considerable filtering capacity, this species reduces the quantity of phytoplankton and zooplankton available for young fish, native mussels and other aquatic invertebrates (MFFP, 2018a). Zebra Mussels can invade a large variety of watercourses and habitats, but generally prefer areas where the substrate is rocky, sandy or densely populated with aquatic vegetation, as well as low-gradient streams. In the study area, Zebra Mussels mainly occur in the Seaway Channel (Dessau-CIMA+, 2013).

3.2.2.2.1.3.2 Quagga Mussel

The Quagga Mussel is an exotic freshwater bivalve that resembles the Zebra Mussel from both a morphological and ecological standpoint. It is considered an invasive species of concern (MFFP, 2018a).

The habitat of the Quagga Mussel is similar to that of the Zebra Mussel, but it can live in colder and deeper waters. Like the Zebra Mussel, the Quagga Mussel attaches to solid surfaces as well as soft substrates such as sand and mud. Contrary to the Zebra Mussel, the Quagga Mussel is capable of colonizing great depths such as the bottom of the Great Lakes and deep sections of the St. Lawrence.

In Quebec, its range in the St. Lawrence is roughly the same as that of the Zebra Mussel, but it does not occur in the Richelieu River or Ottawa River (Figure 33).

Figure 33 – Range of Quagga Mussel (based on MFFP website)

3.2.2.2.1.3.3 Chinese Mystery Snail

The Chinese Mystery Snail is a freshwater snail that occurs in the vast expanses of standing or slow-moving water or low-flow running water characterized by soft, muddy or silty bottoms. Rivers, ponds, lakes, irrigation canals and even ditches dug alongside roads are potential habitats for the species.

It occurs in Canada and is considered well established at some locations in southern and eastern Ontario, including Lake Erie. In Quebec, the species has been reported in southern Montreal and is found in the Lake Champlain Basin (MFFP, 2018a). This exotic species of potential concern is therefore possibly present in the study area.

3.2.2.2.2 Benthos

3.2.2.2.2.1 Methodology

The survey for the benthic community involved the use of two separate methods because of the diversity of the facies that were encountered. Being exploratory, the effort was at the reconnaissance level. The methodology used by the Canadian Aquatic Biomonitoring Network (CABIN, 2014) was favoured for shoreline benthos sampling. This will enable the results to be compared with those from the other adjacent stations in the St. Lawrence. Appendix 9 presents the entire methodology for the survey.

3.2.2.2.2.2 Results

The reference data collected on the shoreline and in deep water can be found in Appendix 9.

3.2.2.2.2.2.1 Shoreline stations

The study area is a section of the St. Lawrence River, located in the Mixwood Plains ecoregion. Surrounding land use is mainly characterized by construction work (New Bridge) and transport corridors, along with some residential areas. The locations of the three shoreline sampling stations are as follows (Map 6):

- BS-01: along Nuns' Island between the Existing Bridge and the Ice Control Structure;
- BS-02: under the Existing Champlain Bridge west of pier 40W;
- BS-06: along Brossard south of the bridge.

The shoreline survey reveals the presence of 31 taxa with the standard inventory method and 3 additional taxa by hand searching (non-standard method), for a total of 34 taxa of inventoried benthic invertebrates (Table 5 in Appendix 9). Organism abundance is very low at stations BS-02 and BS-06, which makes the interpretation of results uncertain. The station BS-01 replicas show varied results; station BS-01B has an abundance of organisms, good taxon diversity, and higher benthic community health indices, including the lowest percentage of Chironomidae and a higher EPT (Ephemeroptera-Plecoptera-Trichoptera) value.

The estimated organism density is low (<75 organisms/m²) for all the samples. However, station BS-01 had more taxa and organisms than the other two stations, regardless of the replicate. The benthos health indices also show that health at this station is good and greater than at the other two stations (Shannon-Wiener diversity index, higher EPT value and %, and lower percentage of Chironomidae and of the two taxa). Stations BS-02 and BS-06 show significant degradation with a very low presence of Ephemeroptera and Trichoptera (low EPT %). A total absence of Plecoptera and virtual absence of the most intolerant taxa from all the shoreline stations (*Rhyacophilidae*, *Ephemerellidae* and unidentified Ephemeroptera) were also noted.

3.2.2.2.2.2.2 Deep-water stations

The deep-water survey shows low diversity, with a total of only 18 taxa (Table 33). Organism abundance is very low at station BS-05 and makes the interpretation of results uncertain. This low abundance is likely caused in part by the lack of current at the station. Station BS-04 has the greatest abundance and higher taxon diversity. In Armellin *et al.* (1997), one station had been created upstream of the Champlain Bridge that had benthic health indices greater than those observed in 2018, but relatively similar to station BS-04. In fact, station BS-04 has the highest relative organism density (576 ind./m²), with the other stations all being below the historical values (587 to 8,596 ind./m²) of Armellin *et al*. (1997).

Regarding health indices, there is an abundance of EPT taxa, intolerant taxa, thus evidencing the site's low level of pollution. The EPT % values are in fact much higher than those observed elsewhere in the St. Lawrence (Armellin, 2017). However, the dissimilar collection methods and the fact that several stations had too low current prevent a more in-depth comparison.

3.2.2.2.3 Summary

The benthic communities sampled in 2018 in the deconstruction project area have generally low diversity. One status species has only a very low probability of occurrence.

With respect to benthos, both the deep-water and shoreline stations showed varied abundance. The deep-water stations also showed varied estimated organism density, while all the shoreline samples had low density.

Regarding macroinvertebrates, both deep-water and shallow-water surveys showed a very low abundance of freshwater mussels, none of which was living.

Table 33 – Benthic community collected at the deep-water stations

PHYLUM	CLASS	ORDER	FAMILY	BS-04	BS-05
Annellida	*Clitellata*	*Oligochaeta*	–	25.5	27
Arthropoda	*Arachnida*	*Acari*	-	5	1
Arthropoda	*Crustacea*	*Amphipoda*	*Gammaridae*	62	
Arthropoda	*Crustacea*	*Amphipoda*	*NI**	3	
Arthropoda	*Crustacea*	*Isopoda*	*Asellidae*	1	
Arthropoda	*Crustacea*	*Copepoda*	-	1	
Arthropoda	*Insecta*	*Diptera*	*Chironomidae*	130	23
Arthropoda	*Insecta*	*Diptera*	*Empididae*	1	
Arthropoda	*Insecta*	*Ephemeroptera*	*Beatidae*	9	
Arthropoda	*Insecta*	*Ephemeroptera*	*Caenidae*	28	
Arthropoda	*Insecta*	*Ephemeroptera*	*Heptageniidae*	2	
Arthropoda	*Insecta*	*Megaloptera*	*Sialidae*	1	
Arthropoda	*Insecta*	*Trichoptera*	*Hydropshychidae*	32	
Arthropoda	*Insecta*	*Trichoptera*	*Hydroptilidae*	1	
Arthropoda	*Insecta*	*Trichoptera*	*Rhyacophilidae*	1	
Mollusca	*Gastropoda*	*Prosobranchia*	*Hydrobiidae*	1	
Mollusca	*Gastropoda*	*Pulmonata*	*Lymnaeidae*	6	1
Mollusca	*Gastropoda*	*Pulmonata*	*Physidae*	2	
Total number of organisms				**311.5**	**53**
Number of taxa				**18**	**5**
Density (number/m²)				576.85	98.15
Shannon-Wiener diversity index (H’)				2.6058	1.3426
Simpson’s evenness index				0.2307	0.4455
HBI				6.4270	7.9057
Number of EPT taxa[1]				7	0
EPT %[1]				24	0
EPT %[1] (without Hydropsychidae)				13	0
% Chironomidae				42	43
% of two dominant taxa				62	94

[1] Ephemeroptera-Plecoptera-Trichoptera

* Non identifiable

3.2.2.3 Herpetofauna

In Quebec, there are 38 species of herpetofauna, including 20 species of amphibians and 18 species of reptiles (AARQ, 2016). The data on the diversity of reptile and amphibian species were obtained from the *Atlas des amphibiens et des reptiles du Québec* (AARQ, 2016), the CDPNQ (2016) and prior studies conducted in the project area.

3.2.2.3.1 Diversity

In the Montreal area, 29 species of herpetofauna were reported (AARQ, 2016), namely, seven salamander species, ten frog and toad species, five turtle species and seven garter snake species (Table 34). Regarding the biophysical environment of the study area, few species are likely to be found there.

Field inventories on snakes, turtles and anurans (frogs and toads) were conducted in the project area in 2012 for purposes of the 2013 EA. Three snake species were identified during the field surveys: the Common Garter Snake, Brown Snake and Redbelly Snake. Most of the individuals of the first two species were observed on Nun's Island, although the Brown Snake was also observed on the Island of Montreal and in the northern part of the long Seaway dike built under the Existing Champlain Bridge.

Several Common Garter Snake individuals and a single Redbelly Snake individual were also found in the Seaway dike. No amphibians or turtles were observed during the 2012 campaign. However, it was noted that wetlands would potentially be a suitable habitat.

An additional field survey on anurans, turtles and garter snakes was conducted in the Champlain Bridge area in 2016 for JCCBI (Aecom, 2017). Active searching and artificial shelters were simultaneously used for garter snakes. Observers scanned waterways to locate turtles on rocks, tree trunks or any other submerged structure that could serve as a basking area. Call listening was the method proposed for anurans. As the above surveys were conducted late in the year, some species could not be assessed and breeding areas were not identified, which was done two years later in the spring (TTC, 2018).

In 2016, the same three species of garter snake were found in artificial shelters in the St. Lawrence Seaway Park and between the Bonaventure Expressway and the St. Lawrence River, while the Painted Turtle and American Toad were also observed in the project area. American Toad calls were heard in a swamp dominated by common water reed and red ash, while the Painted Turtle was found in an artificial shelter set up between the Bonaventure Expressway and the St. Lawrence River in an area dominated by grasses. The spring 2018 campaign led to the detection of the Green Frog (Appendix 10, Map 1).

Table 34 – Herpetofauna species reported in the Montreal area

COMMON NAME	SCIENTIFIC NAME
Class of Reptiles	
Order Testudines (turtles)	
Common Snapping Turtle	*Chelydra serpentina*
Painted Turtle	***Chrysemys picta***
Common Map Turtle	*Graptemys geographica*
Wood Turtle	*Glyptemys insculpta*
Spiny Softshell	*Apalone spinifera*
Suborder Serpentes (snakes)	
Common Garter Snake	***Thamnophis sirtalis***
Northern Watersnake	*Nerodia sipedon*
Redbelly Snake	***Storeria occipitomaculata***
Brown Snake	***Storeria dekayi***
Smooth Green Snake	*Liochlorophis vernalis*
Ringneck Snake	*Diadophis punctatus*
Eastern Milksnake	*Lampropeltis triangulum*
Amphibians	
Order of Urodela (salamanders)	
Mudpuppy	***Necturus maculosus***
Eastern Newt	*Notophthalmus viridescens*
Blue-spotted Salamander	*Ambystoma laterale*
Yellow-spotted Salamander	*Ambystoma maculatum*
Northern Two-lined Salamander	*Eurycea bislineata*
Four-toed Salamander	*Hemidactylium scutatum*
Eastern Red-backed Salamander	*Plethodon cinereus*
Order of Anurans (frogs)	
American Toad	***Anaxyrus (Bufo) americanus***
Tetraploid Grey Treefrog	*Hyla versicolor*
Spring Peeper	*Pseudacris crucifer*
Western Chorus Frog	*Pseudacris triseriata*
Wood Frog	*Lithobates (Rana) sylvaticus*
Northern Leopard Frog	*Lithobates (Rana) pipiens*
Pickerel Frog	*Lithobates (Rana) palustris*
Green Frog	***Lithobates (Rana) clamitans***
Mink Frog	*Lithobates (Rana) septentrionalis*
Bullfrog	*Lithobates (Rana) catesbeianus*

Note: The species in **bold** have a higher likelihood of occurring in or near the project area.

3.2.2.3.2 Habitats

The project area provides a suitable habitat for garter snakes, in particular along the rocky shores of the St. Lawrence on Nuns' Island and the Island of Montreal and the Seaway dike north and south of the Existing Bridge. Although no hibernacle was confirmed other than the one artificially created near the Nuns' Island Ice Control Structure, a potential site was observed south of the highway on the Island of Montreal. For overwintering, garter snakes prefer rock crevices and abandoned burrows below the frost line. JCCBI built a Brown Snake hibernaculum at the entrance to the Ice Control Structure bike path in Cours-du-Fleuve park (JCCBI, 2019). This development, identified as "H13-Estacade Île-des-Sœurs," is being monitored by the MFFP in the Greater Montreal Area (Tessier and Veilleux, 2019). The purpose of the study is to check whether artificial hibernacles are used by snakes and whether they enable them to survive during the winter. Hibernacle H13 was monitored for three consecutive years, from winter 2015-2016 to winter 2017-2018. The results show that the hibernaculum has excellent potential for meeting the needs of the Brown Snake during its hibernation.

Suitable habitats for turtles are rare in the project area given the virtual lack of sand or gravel substrate for building nests, and the fact that the steep, rocky shorelines do not make good basking areas (Stantec, 2015). However, one Painted Turtle was found during the 2016 surveys (Aecom, 2017).

Although the project area provides few habitats suitable for amphibians, the wetlands on the Brossard side near the Existing Champlain Bridge are suitable for frogs and toads. These habitats were confirmed for the American Toad and Green Frog near Avenue Tisserand, at the east end of the bridge (Stantec, 2015; Aecom, 2017; TTC, 2018). There is little potential of occurrence of salamanders in more or less humid areas. No salamanders were observed in the deconstruction project area, although no searches specifically targeted the secretive species during the various field campaigns.

3.2.2.4 Birds

The description of birds requires the very nature of the infrastructure to be considered along with its particular geographic location. The Existing Champlain Bridge is a complex and very impressive structure. For decades, it has served as a nesting site for hundreds of birds, including a large colony of Cliff Swallows and a special-status species, the Peregrine Falcon. Species at risk are covered in detail in section 3.2.2.6.

In addition, the deconstruction of the Existing bridge may have an effect on the birds found in the nearby aquatic and riparian habitats. Regarding the aquatic environment, a fluvial study area extending over roughly 2 km upstream as well as downstream of the Existing Bridge was determined (Map in Appendix 11). For terrestrial birds, the scope of the assessment is limited to a corridor that extends over 500 m upstream and 1 km downstream of the structure. Besides riparian habitats (Montreal, Nuns' Island and Brossard), this corridor includes part of the Seaway dike as well as islands and rocky islets, environments that provide nesting habitats to several species of waterfowl and landbirds. They include the Couvée Islands Migratory Bird Sanctuary, a wildlife habitat protected under the *Migratory Birds Convention Act, 1994* according to the Government of Canada (2018a).

The physical characteristics of the river (e.g. current strength, depth, ice regime) are not very conducive to the establishment of wetlands in the area of the Existing Champlain Bridge. The St. Lawrence still remains a major migratory corridor for birds in general and waterfowl in particular. Based on this determination, the description of birds will cover both breeding and migration.

3.2.2.4.1 Existing data

According to the *Québec Breeding Bird Atlas* (AONQ, 2012), the study area is located within lot 18XR13 of the census sub-divisions of the Atlas, which occupies a surface area of 100 km² (10 km x 10 km). The Atlas database lists a total of 71 species for the above lot (Appendix 11). Note that this number was obtained for an area much larger than the study area.

In addition, based on the information in the bird database system of the Étude des populations d'oiseaux du Québec (ÉPOQ) of Regroupement Québec Oiseaux, 254 species of birds were observed between 1981 and 2010 in the Existing Champlain Bridge and Nun's Island areas, including Lac des Battures.

3.2.2.4.2 Bird migration at the Existing Champlain Bridge

A few species of birds may nest yearly or less frequently on the Existing Champlain Bridge structure. The Common Raven, American Robin, House Sparrow, Rock Dove and Common Grackle are considered as possible nesters on the bridge. In addition, the nesting of the three following species was confirmed on the infrastructure: European Starling, Cliff Swallow and Peregrine Falcon (Groupe Hémisphères, 2011). The populations of the last two species, which are a source of concern in terms of conservation, will be covered more specifically here.

3.2.2.4.2.1 Diversity of species using the bridge structure for nesting

3.2.2.4.2.1.1 Cliff Swallow

Studies on birds, more specifically on the Cliff Swallow, were conducted by JCCBI from 2013 to 2018. During the inventory of Cliff Swallow nests on the Existing Champlain Bridge and its associated structures in fall 2018, most of the sections under the decks could be accessed by boat. The Existing Champlain Bridge, the bypass bridge (causeway), Clément Bridge and the Ice Control Structure were inventoried. However, some spans under the Champlain Bridge were not part of the annual inventory because platforms (or other types of structures obstructing the view) were installed at the time of the inventory, making it impossible to do a nest count.

With respect to the number of nests on the Existing Champlain Bridge, although they increased in 2017, the 2018 inventory shows a decrease in all sections (5 and 7) (Map 10). For a second consecutive year, almost all the section 5 spans could be inventoried (except for 42W to 44W). The drop in section 5 can be explained by the considerable work being done on this section. Section 7 of the Existing Champlain Bridge appears fairly stable in terms of numbers or slightly declining over the past few years.

In general, the loss of nests is not always attributable to construction work but may be largely caused by natural conditions. In fact, nests fall down or break up over time when certain situations occur (Brown and Brown, 1995), such as:

- Heavy rain (along with wind) soaks the nests, causing them to break apart and/or fall down;
- Very hot weather dries up the nests and the nest floor crumbles;
- Hot and humid weather over an extended period of time can also make nests more friable to the point of crumbling and falling down.

In general, the nests on the Existing Champlain Bridge are located under the deck at the junction of a diaphragm or under the beam, at the junction with a diaphragm (this is also the case for the Clément Bridge). Nests are also found in diaphragm holes or in the metal cavities of the posts on the Existing Champlain Bridge.

The Cliff Swallow population on the Ice Control Structure has been on the rise, with the highest numbers ever seen since inventories were begun in 2013 (Map 10). This increase may be due to couples relocating from the Existing Champlain Bridge to the Ice Control Structure. In addition, the beams added in 2015 provide a prime habitat for Cliff Swallows since these structures are almost all used to their maximum capacity. They represent a significant advantage for maintaining the Cliff Swallow population of the Existing Champlain Bridge and associated structures (Photo 18).

Photo 18 – Cliff Swallow using beams for nesting

There has been a slight decrease in the number of nests on the causeway-bridge. However, the population may have reached its colonization limit and may be levelling off. Partially eroded nests were observed during the inventories. Since this is the third year, some nests may have become completely eroded.

The Cliff Swallow population on the Clément Bridge is also experiencing a slight decline, but given the years 2015 and 2016, this may be a slight natural fluctuation in the population.

Map 10 - Nest location : Existing Champlain Bridge, Nuns' Island bridge and Ice Control Structure

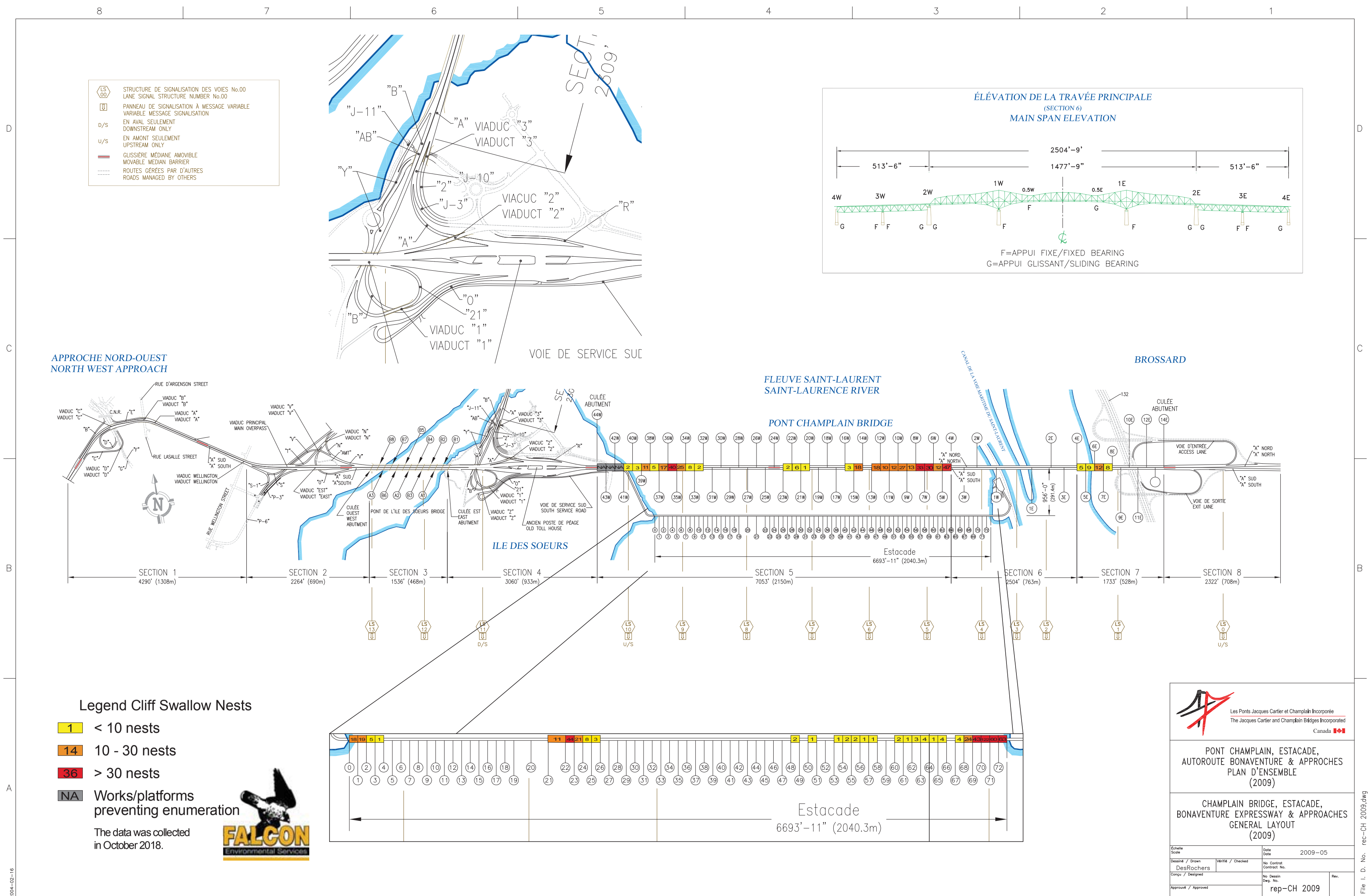


Table 35 – Inventory of Cliff Swallow nests on the Champlain Bridge and associated structures since 2015

2015	2016	2017	2018
CHAMPLAIN BRIDGE			
520*	257*	489*	379*
ICE CONTROL STRUCTURE			
325*	292	353	471
CLÉMENT BRIDGE			
61*	73	110	82
CAUSEWAY-BRIDGE			
0	118	202	191
Total			
906	740	1154	1123

* : Partial-inventory data since some spans could not be accessed.
Source: Falcon Environmental Services (2017).

In June 2018, nest activity was monitored on all the structures, included those accessible by boat. However, nest activity is a sampling where some spans were selected by section in a random manner to obtain a percentage of activity that is representative of the Cliff Swallow population on each bridge. In 2017, active nests on the Existing Champlain Bridge represented slightly more than half the inventoried nests (52%), whereas activity was slightly higher in 2018 (66%). Active nests on the Ice Control Structure represented 79% of inventoried nests in 2018 compared to 75% in 2017.

3.2.2.4.2.1.2 Peregrine Falcon

The Peregrine Falcon is considered a vulnerable species in Quebec under the *Act Respecting Threatened or Vulnerable Species*. At the federal level, the Peregrine Falcon is still currently listed as a species of special concern in the *Species at Risk Act* (SARA; Schedule 1), although since November 2017, COSEWIC considers that Peregrine Falcon populations in Canada have recovered and therefore the species is no longer at risk. Despite this recent improvement, the Peregrine Falcon is still a major factor to consider in relation to the present project, since each Peregrine Falcon nesting site is not only still a source of concern for conservation but also for the safety of workers working near the nests.

3.2.2.4.2.2 Diversity of species that use the infrastructures for nesting

Over the years, over 250 species of birds have been reported in the vicinity of the Existing Champlain Bridge. In June 2012, targeted inventories were conducted for more precise descriptions of the birds nesting on the infrastructures, the islands and the shorelines likely to be affected by the construction of the New Bridge over the St. Lawrence, including the Nun's Island bridge, which will also be replaced (Dessau-Cima+, 2013). The study pertained to the Seaway dike along with the Nun's Island and Brossard shorelines. The environments that were covered mainly consisted of scrubland and uncultivated grassland along with small deciduous forests (mainly poplar), which often dominate the narrow riparian strip.

A relatively modest list of 41 species was obtained. This is a community of birds specific to open and urban environments and made up of common species in southern Quebec. The most numerous species consisted of the European Starling (up to 159 individuals), Red-winged Blackbird (118), Ring-billed Gull (98), American Yellow Warbler (87), American Cliff Swallow (77), Cedar Waxwing (74) and Mallard (59).

The highest densities of breeding pairs were reported for the Red-winged Blackbird (2.88 pairs/ha), American Yellow Warbler (1.91), Cedar Waxwing (1.11) and Song Sparrow (0.93). The Peregrine Falcon (1 to 3 individuals) and Chimney Swift (2 individuals), two special-status species, were also on the list of records reported during the nesting season.

3.2.2.4.2.3 Waterfowl and birds of prey that use the water environment

The 2016 field campaign (Aecom, 2017) identified the population of early nesters, which mainly consist of waterfowl and other waterbirds or raptors. According to Aecom (2017), four species of duck were observed in addition to the Canada Goose. The most abundant species was the Mallard with 44 adults, including 17 breeding pairs and two broods of 9 and 3 ducklings. The American Black Duck, Gadwall and Blue-winged Teal accounted for less than half of the above cohort.

The species in the other groups included the Osprey, Peregrine Falcon, Double-crested Cormorant, Common Term, Ring-billed Gull, Spotted Sandpiper and Great Blue Heron.

3.2.2.4.2.4 Colonies near the infrastructures

The dike and most of the islands along the south shore were created artificially using sediment dredged from the bottom of the St. Lawrence during the construction of the Seaway. These islands became progressively vegetated and some have since then been used as nesting areas by a few species of land birds as well as ducks and larids. In this regard, the largest of these islands between the Existing Champlain Bridge and Victoria Bridge experienced significant growth with the establishment of a major Ring-billed Gull colony.

In 1986, this situation led the federal government to include this island and the adjacent islands in its national network of protected areas, a site now designated as and called “Couvée Islands Migratory Bird Sanctuary” totalling 15 ha.

In 1994, over 30,000 gull nests were counted at the sanctuary. Three years later, only 20,870 pairs remained. During an inventory conducted in 2006, only 9,293 pairs were counted, and since 2009, no mention of Ring-billed Gull nests was reported at the sanctuary. Fox predation is the most plausible reason for why the nesting population of the species abandoned the area (Government of Canada, 2017a). During the most recent waterfowl surveys conducted in this area, up to 300 adult Ring-billed Gulls were reported on the large island in the grouping, but there are no signs to indicate that nesting may have resumed in the Migratory Bird Sanctuary (MBS) in 2018 (PTA, 2018).

3.2.2.4.3 Bird migration at the Existing Champlain Bridge

The daily activities of waterfowl often extend over large areas, in particular during migration and overwintering. A waterfowl migration inventory was conducted to cover most of the two waterfowl gathering areas (WGAs) found in the sector. Three different campaigns were conducted: fall 2012 (Dessau-Cima+, 2013), fall 2016 (Aecom, 2017) and spring 2018 (PTA, 2018).

The St. Lawrence is a major migratory corridor for birds in general, especially waterfowl. Furthermore, when they land in open spaces, these species may prove to be fairly sensitive to disturbances. Given the above factors, the configuration of the river and that of three nearby designated wildlife habitats, the migration study area extends a few kilometres upstream as well as downstream (Appendix 10, Map 1).

3.2.2.4.3.1 Diversity noted on the St. Lawrence during migration

Bird migration inventories conducted specifically for the original Champlain Bridge were used to draw up bird diversity over the last years during migration. A total of 35 species were inventoried on the St. Lawrence during the spring and fall (Table 36). Most of these species stop to feed or rest, while a small number are only passing through (PTA, 2018).

One of the main differences noted during bird migration observations is that there is a much greater concentration of birds upstream of the Existing Bridge. In terms of individuals, the 2018 spring inventory showed that each visit revealed ten times more Anatidae in the Greater La Prairie Basin portion (between the Existing Champlain Bridge and the Lachine Rapids) compared to the section between the Existing Champlain Bridge and Victoria Bridge. Current speed, which is greater downstream of the Existing Champlain Bridge, may have been a factor in the birds' choice, especially as a staging area.

3.2.2.4.3.2 Waterfowl gathering areas (WGA)

In the vicinity of the Existing Champlain Bridge, there are two wildlife habitats that are legally protected under the *Act Respecting the Conservation and Development of Wildlife*. They consist of two WGAs upstream of the Existing Bridge in the La Prairie basin, more specifically the La Prairie basin (Nuns' Island) WGA (protected area no. 02-06-0167-1988) alongside the Existing Bridge and totalling 389 ha, and the Grand Herbier WGA (protected area no. 02-06-0122-1984) totalling 903 ha, as shown on the map in Appendix 11.

Information obtained from studies by the Canadian Wildlife Service on waterfowl indicate that the main species inventoried in the last century are the Ring-billed Gull, dabbling ducks such as the American Wigeon, Northern Pintail, Mallard and Black Duck, and diving ducks such as scaups and the Common Goldeneye. More recent aerial surveys conducted in the spring of 2004, 2007 and 2008 counted 381 birds, not including gulls. The most abundant species (in descending order) are the Mallard, Ring-necked Duck, American Wigeon, Double-crested Cormorant, Black Duck, Common Merganser, scaup (unidentified species), Gadwall, Canada Goose, Bufflehead, Great Blue Heron, Ring-billed Gull, Great Black-backed Gull, Black Scoter, Hooded Merganser and Common Loon (Dessau-Cima+, 2013).

Table 36 – Diversity noted on the St. Lawrence during migration

FAMILY	COMMON NAME	SCIENTIFIC NAME	STATUS[1,2]
ANATIDAE	Canada Goose	*Branta canadensis*	
	Gadwall	*Anas strepera*	
	American Wigeon	*Anas americana*	
	Mallard	*Anas platyrhynchos*	
	Black Duck	*Anas rubripes*	
	Blue-winged Teal	*Anas discors*	
	Greater Scaup	*Aythya marila*	
	Surf Scoter	*Loxia*	
	Long-tailed Duck	*Clangula hyemalis*	
	Bufflehead	*Bucephala albeola*	
	Common Goldeneye	*Bucephala clangula*	
	Hooded Merganser	*Lophodytes cucullatus*	
	Common Merganser	*Mergus merganser*	
	Red-breasted Merganser	*Mergus serrator*	
PODICIPEDIDAE	Pied-billed Grebe	*Podilymbus podiceps*	
LARIDAE	Bonaparte's Gull	*Chroicocephalus philadelphia*	
	Ring-billed Gull	*Larus delawarensis*	
	European Herring Gull	*Larus argentatus*	
	Great Black-backed Gull	*Larus marinus*	
	Common Tern	*Sterna hirundo*	
GAVIIDAE	Common Loon	*Gavia immer*	
PHALACROCORACIDAE	Double-crested Cormorant	*Phalacrocorax auritus*	
ARDEIDAE	Great Blue Heron	*Ardea herodias*	
	Great Egret	*Ardea alba*	
ALCEDINIDAE	Belted Kingfisher	*Megaceryle alcyon*	
APODIDAE	Chimney Swift	*Chaetura pelagica*	*1-2*
FALCONIDAE	American Kestrel	*Falco sparverius*	
	Merlin	*Falco columbarius*	
	Peregrine Falcon	*Falco peregrinus*	*1-2*
CORVIDAE	Common Raven	*Corvus corax*	
HIRUNDINIDAE	Purple Martin	*Progne subis*	
	Tree Swallow	*Tachycineta bicolor*	
	Barn Swallow	*Hirundo rustica*	*2*
	Cliff Swallow	*Petrochelidon pyrrhonota*	

[1] Species likely to be designated as threatened or vulnerable in Quebec under the *Act Respecting Threatened or Vulnerable Species*
[2] Species considered endangered in Canada under the *Species At Risk Act* (Government of Canada, 2019)
Sources: PTA (2018); Aecom (2017); Dessau-Cima+ (2013).

During field campaigns in the project area during migration (Table 37), a few thousand birds mainly from the Anatidae family were inventoried. Most consisted of diving ducks, namely goldeneyes, mergansers and scaups. Of this number, most were seen to be feeding or resting (PTA, 2018).

Table 37 presents the observed abundance and diversity of Anatidae during migration.

The assessment was done based on the criteria established by the MFFP (2016a) to define what a WGA is. The densities were established based on the proportion of the area covered by the observer.

Table 37 – Abundance and density of Anatidae during migration

SEASON (MONTH)	NUN'S ISLAND WGA (NO. 02-06-0167-1988)		GRAND HERBIER WGA (NO. 02-06-0122-1984)	
Fall 2012 (October)	Individuals counted	233	–	–
Fall 2016 (October)	Individuals counted	77	–	–
Spring 2018 (April to May)	Area covered (ha)	370	Area covered (ha)	722
	Individuals counted	77	Individuals counted	997
	Average daily number	15,4	Average daily number	199,4
	Density (no./km²)	4,2	Density (no./km²)	27,6

Sources: PTA (2018); Aecom (2017); Dessau-Cima+ (2013).

3.2.2.4.4 Overwintering population near the Existing Champlain Bridge

The data gathered for the Christmas Bird Counts (CBC)[3] from 1931 to 2015 were obtained from the National Audubon Society (2016) for the Montreal count circle, which covers the project area. Over 180 taxa were observed during at least one count year, whereas about 40 species were regularly sighted during the count (i.e. observed during more than half of the 80 counts made from 1931 to 2015), including several species of waterfowl overwintering on open water in the St. Lawrence (Appendix 11).

3.2.2.4.5 Habitats

During their migration, thousands of ducks gather in the St. Lawrence, including in the project area, which is located in breeding conservation area (RCA) 13: Lower Great Lakes/St. Lawrence Plain. A few species overwinter in the greater Montreal area, including the Black Duck, Mallard, Common Goldeneye and Common Merganser (Lepage et al., 2015). As previously mentioned, the species that are tolerant of urban environments occur to a greater extent in the project area (Dessau-Cima+, 2013).

[3] The Christmas Bird Count is an inventory of birds across North America carried out by volunteers during a given day between December 14 and January 5 of each year, in plots (count circles) 24 km in diameter that are the same year after year. The data are contained in a database managed by the National Audubon Society and are used for long-term monitoring of bird diversity during this time of year.

The St. Lawrence and its islands are important habitats for nesting, migration and overwintering for waterfowl and other species of aquatic birds. WGAs are in fact found in the La Prairie basin. Upstream of Nun's Island, an Important Bird Area (IBA) is also found. This is a global cooperation initiative headed by BirdLife International and implemented in Canada by Nature Canada and Bird Studies Canada (IBA, 2016). These protected areas play a key role in the survival of certain bird species.

Near the Existing Champlain Bridge, the terrestrial habitat mainly consists of grassy fields and cottonwood tree stands, with a few stands of black locust and red ash, as well as staghorn sumac fields. Lastly, there are few wetlands near the St. Lawrence shore (Dessau-Cima+, 2013).

The actual structure of the Existing Champlain Bridge provides a nesting habitat for some species of birds known to nest on cliffs and to be tolerant of urban environments. These species are the Peregrine Falcon and the Cliff Swallow, respectively protected by SARA and MBCA.

3.2.2.4.6 Summary

The Existing Champlain Bridge, the surrounding infrastructures and the nearby aquatic and riverside environments play an important role for birds. In fact, protected areas are found near the bridge: the Couvée Islands MBS, the La Prairie Basin WGA, the Grand Herbier WGA and an IBA located upstream of Nuns' Island. Several inventories were carried out during nesting and migration in the project area between 2012 and 2018.

The structure of the Existing Champlain Bridge serves as a nesting site for a major Cliff Swallow colony and a special-status species, the Peregrine Falcon. It was also confirmed that the European Starling was nesting on the Existing Champlain Bridge. The 2018 inventory revealed a decrease in the number of Cliff Swallow nests on sections 5 and 7 of the Champlain Bridge, whereas the Cliff Swallow population nesting on the Ice Control Structure has been growing since 2013. This increase may be due to couples relocating from the Existing Champlain Bridge to the Ice Control Structure. On the surrounding infrastructures of the Existing Champlain Bridge, the Seaway Dike and the Nuns' Island and Brossard islands and shores, the 2012 inventory revealed modest diversity, i.e. 41 species common to southern Quebec and tolerant of urban environments. In aquatic areas, the 2016 campaign revealed that the population of early nesting birds was mainly represented by waterfowl as well as other waterbirds or raptors, with the most abundant species being the Mallard.

The campaigns conducted in 2012, 2016 and 2018 on the migration of waterbirds in the spring and fall in the vicinity of the Existing Champlain Bridge led to an inventory of 35 species, mostly diving ducks.

The main issues associated with birds consist of the presence of Cliff Swallow and Peregrine Falcon nesting sites on the Existing Champlain Bridge, as well as the disturbance caused by deconstruction work on species using the infrastructures and the surrounding protected areas.

3.2.2.5 Bats

During the 2013 EA (Dessau-Cima+, 2013), no bat surveys were conducted on JCCBI property in the corridor of the Existing Champlain Bridge. In 2016, an inventory on the biodiversity of wildlife, including bats, was carried out in this area (Aecom, 2017).

3.2.2.5.1 Diversity

In Quebec, there are eight species of bats that are part of the same family, i.e. vespertilionidae (MFFP, 2016b). In the past few years, bat populations have been significantly affected by white-nose syndrome, a fungal infection first identified in eastern North America in the winter of 2006-2007 (MFFP, 2018b). Cave-dwelling and insectivorous species are particularly affected, such as the Little Brown Myotis, Northern Long-eared Myotis, Big Brown Bat and Tri-colored Bat.

The 2016 inventory in the area around the Existing Champlain Bridge indicated that some bat species are likely to occur in small forests and on the banks of the St. Lawrence (see Table 38). Although most bats are at risk, the CDPNQ (2016) did not identify any status mammals within a 8-km radius from the middle of the Existing Champlain Bridge.

Table 38 – Species of bat likely to occur in the project area

COMMON NAME	SCIENTIFIC NAME	PROVINCIAL STATUS[1]	FEDERAL STATUS	
			SARA, SCHEDULE 1	ASSESSMENT COSEWIC
Red Bat	*Lasiurus borealis*	Likely to be designated	–	–
Small-footed Bat	*Myotis leibii*	Likely to be designated	–	–
Hoary Bat	*Lasiurus cinereus*	Likely to be designated	–	–
Little Brown Myotis	*Myotis lucifugus*	–	Endangered	Endangered
Big Brown Bat	*Eptesicus fuscus*	–	–	–
Northern Long-eared Myotis	*Myotis septentrionalis*	–	Endangered	Endangered
Silver-haired Bat	*Lasionycteris noctivagans*	Likely to be designated	–	–
Tri-colored Bat	*Perimyotis subflavus*	Likely to be designated	Endangered	Endangered

[1] *Act Respecting Threatened or Vulnerable Species*

Source: Aecom, 2017.

3.2.2.5.2 Habitats

There do not appear to be any habitats suitable for nesting or that could serve as a hibernation site in the project area (Aecom, 2017; GCQ, 2018). Small wood lots would be hardly suitable for forest bats, which prefer mature forests for nesting. Hence, it is unlikely that cave bats use the actual structure of the Existing Champlain Bridge since it does not contain any internal cavities. However, since bats feed on insects near waterways and wetlands, they may occur on the banks of the St. Lawrence, especially species that are tolerant of urban and semi-urban environments, such as the Big Brown Bat. Therefore, bats do not represent an issue for this project.

3.2.2.6 Special status species of wildlife

Special-status species are protected under federal and provincial legislation. At the federal level, SARA and COSEWIC designate and group species in one of the following categories: extirpated (extinct in Canada); endangered; threatened; of special concern; insufficient data; not at risk (Government of Canada, 2014). In Quebec, the *Act Respecting Threatened or Vulnerable Species* designates species that are threatened, vulnerable or likely to be designated threatened or vulnerable (“likely to be designated”).

The designation of species is constantly changing to take into account changes in animal populations over time, which makes it necessary to review the list of special-status species potentially present in the study area and observed since 2013 at the time of the Dessau-Cima+ study (2013).

3.2.2.6.1 Prevailing situation

During the 2013 EA, a request was submitted to the CDPNQ to identify a list of the special-status species occurring within an 8-km radius around the Existing Champlain Bridge. This request revealed the local occurrence of 14 species of fish, two species of molluscs, two species of amphibians, six species of reptiles and six species of birds with a special status. No status mammals were inventoried within the above radius (Dessau-Cima+, 2013). Several of these species are potentially found in the study area.

During the inventories conducted in 2012, three status species were observed in the study area: the Brown Snake, the Peregrine Falcon and the Chimney Swift (Dessau-Cima+, 2013). No status fish were inventoried given that the 2012 inventories did not include any fishing. However, Aecom conducted some experimental fishing in 2016.

Table 39 summarizes the status species potentially present and those observed during field surveys related to the New Champlain Bridge (including the study areas around the New Bridge and the Existing Bridge). Note that the definition of "potentially present" includes species inventoried nearby whose breeding habitat is consistent with known breeding habitats in the study area.

3.2.2.6.2 Current situation

3.2.2.6.2.1 New designations

The following points describe the provincial or federal designations that have changed since the 2013 Environmental Assessment:

- The Longear Sunfish, formerly "likely to be designated," is no longer on the list of species likely to be designated threatened or vulnerable under the *Act Respecting Threatened or Vulnerable Species*;
- The Channel Darter, once designated as "threatened" under SARA, is now a species of "special concern";
- The Northern Sunfish, formerly designated a Longear Sunfish subspecies, has been added to ARTVS and SARA under the designations "likely to be designated" and "threatened," respectively;
- The Northern Brook Lamprey is now designated as "threatened" under the ARTVS and of "special concern" under SARA;
- The Cutlip Minnow and the Silver Lamprey have been added to Schedule 1 of the SARA with as species of "special concern";
- The American Eel, which formerly had a "special concern" designation, is now designated as "threatened" according to COSEWIC;

Table 39 – List of special-status wildlife species inventoried by the CDPNQ within an 8-km radius and observed during the Champlain Bridge field surveys

COMMON NAME	LATIN NAME	LOCAL PRESENCE (CDPNQ)[1]	OBSERVED DURING 2012 INVENTORIES[2]	OBSERVED DURING 2013 - 2018 INVENTORIES[3]	PROVINCIAL STATUS[4]	FEDERAL STATUS (SARA[5] / COSEWIC)[6]
Fish fauna						
Bridle Shiner	*Notropis bifrenatus*	X*			Vulnerable	Special concern
Lake Sturgeon	*Acipenser fluvescens*	X*		X	Likely to be designated	- / Threatened
Atlantic Sturgeon	*Acipenser oxyrinchus*	X			Likely to be designated	–
River Redhorse	*Maxostoma carinatum*	X*			Vulnerable	Special concern
Copper Redhorse	*Maxostoma hubbsi*	X*			Threatened	Endangered
Longear Sunfish	*Lepomis megalotisi*	X			–	–
American Shad	*Alosa sapidissima*	X		X	Vulnerable	–
American Eel	*Anguilla rostrata*	X		X	Likely to be designated	- / Threatened
Stonecat	*Noturus flavus*	X*			Likely to be designated	–
Channel Darter	*Percina copelandi*	X*			Vulnerable	Special concern
Chain Pickerel	Esox niger	X			Likely to be designated	–
Grass Pickerel	*Esox americanus vermiculatus*	X			Likely to be designated	Special concern
Rainbow Darter	*Etheostoma caeruleum*	X			Likely to be designated	–
Rosyface Shiner	*Notropis rubellus*	X			Likely to be designated	–
Striped Bass	*Morone saxatilis*			X	–	Endangered
Molluscs						
Spike	*Elliptio dilatata*	X*			Likely to be designated	–
Elephantear	*Elliptio crassidens*	X*			Likely to be designated	–
Hickorynut	*Obovaria olivaria*				Likely to be designated	Endangered
Herpetofauna						
Western Chorus Frog	*Pseudacris triseriata*	X*			Vulnerable	Threatened
Pickerel Frog	*Lithobates palustris*	X*			Likely to be designated	–
Spiny Softshell	*Apalone spinifera*	X*			Threatened	Endangered
Common Map Turtle	*Graptemys geographica*	X*			Vulnerable	Special concern
Midland Painted Turtle	*Chrysemys picta marginata*			X	–	- / Special concern
Ringneck Snake	*Diadophis punctatus*	X*			Likely to be designated	–
Eastern Milksnake	*Lampropeltis Triangulum*	X*			Likely to be designated	Special concern
Brown Snake	*Storeria dekayi*	X*	X	X	Likely to be designated	–
Smooth Green Snake	*Opheodrys vernalis*	X*			Likely to be designated	–

COMMON NAME	LATIN NAME	LOCAL PRESENCE (CDPNQ)[1]	OBSERVED DURING 2012 INVENTORIES[2]	OBSERVED DURING 2013 - 2018 INVENTORIES[3]	PROVINCIAL STATUS[4]	FEDERAL STATUS (SARA[5] / COSEWIC)[6]
Birds						
Least Bittern	*Ixobrychus exilis*	X*			Vulnerable	Threatened
Bald Eagle	*Haliaeetus leucocephalus*	X*			Vulnerable	–
Peregrine Falcon *anatum*	*Falco peregrinus anatum*	X*	X	X	Vulnerable	- / -
Yellow Rail	*Coturnicops noveboracensis*	X*			Threatened	Special concern
Common Nighthawk	*Chordeiles minor*					Threatened / Special concern
Red-headed Woodpecker	*Melanerpes erythrocephalus*	X*			Threatened	Threatened / Endangered
Grasshopper Sparrow	*Ammodramus savannarum*	X			Likely to be designated	–
Chimney Swift	*Chaetura pelagica*	*	X	X	Likely to be designated	Threatened
Barn Swallow	*Hirundo rustica*			X	–	Threatened

[1] Request to the CDPNQ in 2012; X* = species on the CDPNQ list in 2012 and 2016; * = Species on the list in 2016 only

[2] Source: Dessau-Cima+, 2013

[3] Source: SEF, 2014; Aecom, 2017; TTC, 2018; PTA, 2018

[4] Current designation under the Act Respecting Threatened or Vulnerable Species

[5] Current designation under SARA

[6] Current designation according to COSEWIC. An entry in the last column means that the designation is the same under SARA and COSEWIC.

- The Striped Bass population in the St. Lawrence was considered extirpated (extinct in Canada) under SARA. However, due to recovery efforts, the species' presence is now confirmed in the study area (Government of Canada, 2019) and is currently designated as "endangered";
- The designation of the Spiny Softshell Turtle in SARA was changed from "threatened" to "endangered"; The Hickorynut is now designated as "likely to be designated" under the ARTVS and has been added to Schedule 1 of the SARA as "endangered".

3.2.2.6.2.2 Potential species

A request was once again submitted to the CDPNQ prior to the 2016 wildlife inventory (Aecom, 2017). It also included an 8-km radius around the Existing Champlain Bridge. As part of this update, the occurrences received from the CDPNQ indicate the presence of six species of fish, two species of molluscs, two species of amphibians, six species of reptiles and six species of birds with a special status (CDPNQ, 2016). This list is found in Table 39. As during the 2012 inventories, no status mammals were inventoried within the above radius.

Other special-status species potentially present in the study area have been added since then to the list, since COSEWIC only entered them recently or recent inventories led to their observation, as described in the section below.

3.2.2.6.2.3 Species observed

Inventories conducted since 2013 have confirmed that six other special-status species occur in the study area or near it: Lake Sturgeon, American Eel, Striped Bass, American Shad, Painted Turtle and Barn Swallow. The status species already observed in 2012 were also inventoried between 2013 and 2018.

Map 1 in Appendix 10 shows the special-status wildlife species observed during the 2013-2018 inventories.

3.2.2.6.3 Invasive or alien species

Special attention was given to the presence of invasive or alien species (IAS) of wildlife in the study area during the 2016 inventories (Aecom, 2017). In addition, during the additional aquatic environment survey conducted in 2018, an effort targeting macroinvertebrates included the detection of freshwater mussels and crayfish (PTA, 2018).

Table 40 presents the IAS that have been confirmed or that are potentially present in the study area. This information is new, as IAS were not covered in the 2013 EA.

Table 40 – List of invasive or alien species whose occurrence is confirmed or likely in the study area

COMMON NAME	SCIENTIFIC NAME	LIKELY OCCURRENCE IN STUDY AREA	CONFIRMED OCCURRENCE IN STUDY AREA
Rusty Crayfish	*Orconectes rusticus*	X	
Gobie à taches noires	*Neogobius melanostomus*		X
Rainbow Trout	*Oncorhynchus mykiss*		X
Asian Carp	*Lasiurus cinereus*	X	
Chinese Mystery Snail	*Cipangopaludina/Bellamya chinensis*	X	
Goldfish	*Carassius auratus*	X	
Zebra Mussel	*Dreissena polymorpha*		X
Quagga Mussel	*Dreissena bugensis*	X	

Source: Government of Canada, 2017b; MFFP, 2018b; PTA, 2018.

The biology and range of these species are discussed in section 3.2.2.6.3 of this report on fish.

3.3 HUMAN ENVIRONMENT

3.3.1 ADMINISTRATIVE FRAMEWORK

The administrative framework described in section 4.3.1 of the 2013 EA (Dessau-Cima+, 2013) is still valid, insofar as the boroughs in the project area and their jurisdictions have not changed. Only slight variations in the demographic data were noted.

3.3.2 ABORIGINAL COMMUNITIES

The 2013 EA involved the Mohawk Nation, whose recognized and affirmed Aboriginal and treaty rights were potentially impacted by the NBSL construction project. The following sections provide an overview of the two Mohawk communities in the Montreal area.

3.3.2.1 Mohawk community of Kahnawake (Kahnawà:ke)

The Mohawk community of Kahnawake is located on the south shore of Lake Saint-Louis, about 10 km south-west of Montreal. The reserve has an area of approximately 50 km^2 (AANC, 2015a).

As of January 2019, Kahnawake had a total population of 11,037, including 7,922 persons living on the reserve (AANC, 2019a).

In 2011, 43% of persons living in Kahnawake were under the age of 35, while those aged 60 and over made up 20% of the population (KSCS, 2013). In 2005-2006, the average household income on the reserve was $37,153 and the unemployment rate was between 3 and 11%.

The Mohawk Council of Kahnawake (MCK) is made up of 12 representatives: a Chief and Council elected by the population.

The MCK organizational structure consists of two main areas: political and administrative-operational. The political part consists of the Council of Chiefs and the Office of the Council of Chiefs, who respectively provide strategic guidance and advisory services to the MCK. The administrative-operational part involves areas such as public relations and communication; legal services; human resources; Mohawk language and culture (kanien'kéha); finance and asset management;

infrastructure services; land and the environment; public safety and justice, including the Court of Kahnawake (MCK, 2016).

3.3.2.2 Mohawk community of Kanesatake (Kanehsatà:ke)

The Mohawk community of Kanesatake is located on the north shore of the Ottawa River near Lake of Two Mountains, about 50 km west of Montreal. It has an area of approximately 12 km^2 (AANC, 2015b).

As of January 2019, the total population of Kanesatake was 2,583, including a residential population of 1,381 (AANC, 2019b). In 2008-2009, two-thirds of the Kanesatake population were between 18 and 64 years of age, while 20% was under 18; the remaining 14% were 65 and over (CSSSPNQL, 2013). The languages spoken are English, Mohawk and French (SAA, 2009).

In 1991, the community of Kanesatake voted to replace its traditional matrilineal system with a political-electoral system (MCK, 2015). The Mohawk Council of Kanesatake is made up of seven representatives: a Grand Chief and council chiefs, elected by the population.

Kanesatake has a special territorial situation. Land acquired by the federal government for the benefit of the Mohawks does not constitute a reserve under the *Indian Act*, but rather federal land reserved for them under the *Constitution Act (1867)*. In 1945, the federal government purchased land from the Sulpicians that was still occupied by the Mohawks, made up of parcels in Oka separated by privately held land; subsequent purchases by the federal government contributed to the patchwork of properties (Loiselle-Boudreau, 2009).

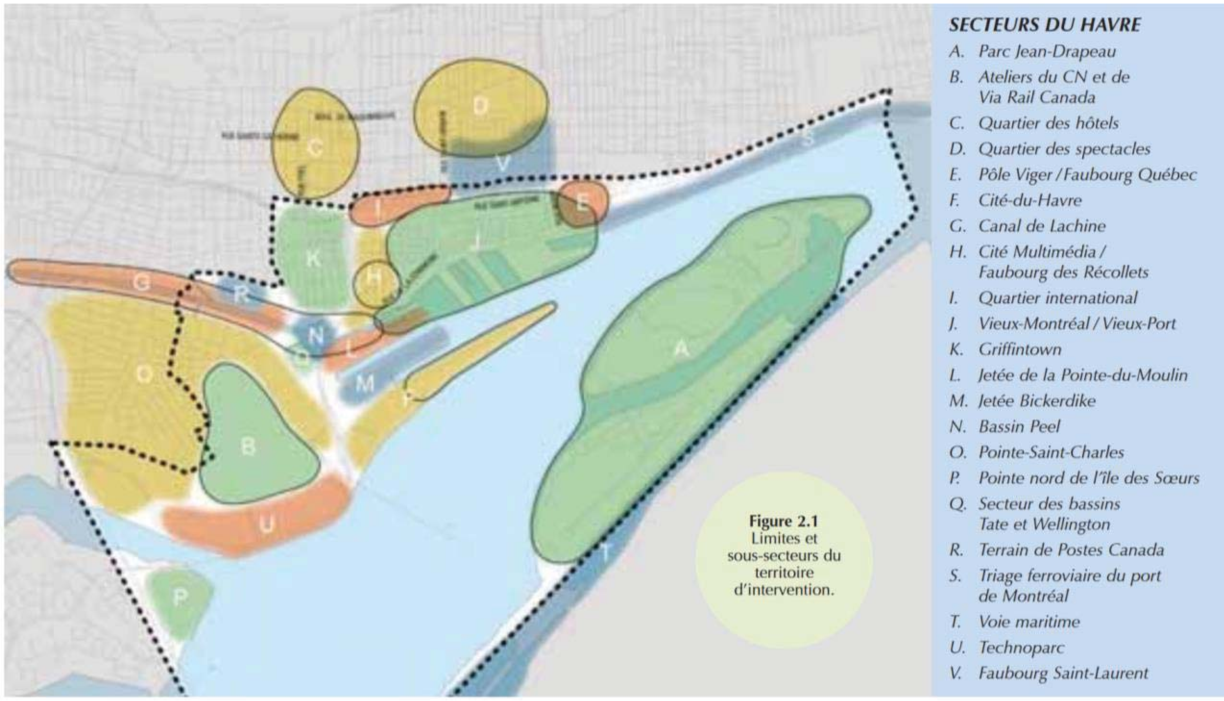
Adopted in 2001, the *Kanesatake Interim Land Base Governance Act* (Bill S-24) gives Kanesatake the authority to enact laws in many areas, including health, wildlife protection and management, fire safety and protection services, housing, construction and maintenance of local work, construction and regulation of the water supply, construction of buildings, including the inspection or renovation of spaces, management and remediation of waste, and traffic management (AANC, 2016c).

3.3.3 LAND USE

Land use is determined by the urban plans of the municipalities directly involved by the project, i.e. Montreal and Brossard. The urban plans document the socio-economic planning and development visions for the municipalities' territory and define the use of the established areas and the activities permitted in these areas. These are based on past and current uses, the target objectives for the territory, and the physical potential of each zone.

Since land use changes periodically, the relevant documents were consulted to determine whether there have been any changes in this respect in the project area.

The land-use planning and development plan for the agglomeration of Montreal (by-law RCG 14-029) has been in force since April 1, 2015. This document defines the objectives for the next decade in terms of urban planning and development, in addition to identifying strategic and priority areas to be transformed. One of them is adjacent to the project area, namely, the Montreal Harbourfront, which includes the entire shoreline between the Champlain Bridge and the Old Port of Montreal, including the northern tip of Nuns' Island (Ville de Montréal, 2017a), as shown in Figure 34. The projected areas for the deconstruction work are located just outside the Harbourfront.



Source: SHM, 2004.

Figure 34 – Harbourfront area

The Harbourfront is also identified in the Communauté métropolitaine de Montréal's metropolitan land use and development plan as being part of "landscapes of metropolitan interest" to be protected or enhanced. The plan establishes objectives over 20 years for urban development, transportation and the environment over the entire metropolitan area, thus guiding the development of land-use and development plans for agglomerations or regional county municipalities (CMM, 2012).

The City of Montreal's policies for the Harbourfront include enhancing the shoreline, defining the main urban uses and the type of road, public and active transport infrastructures in the area, as well as the measures that will ensure the quality of the entrance to the city as well as a better relationship with the St. Lawrence and Lachine Canal (Ville de Montréal, 2017b).

Under objective 2.3 of the Plan, which aims at optimizing the road network to support the movement of people and goods, the replacement of the Champlain Bridge has been identified as one of the main metropolitan road improvement projects (CMM, 2012). The deconstruction of the Existing Bridge is therefore in line with the Plan.

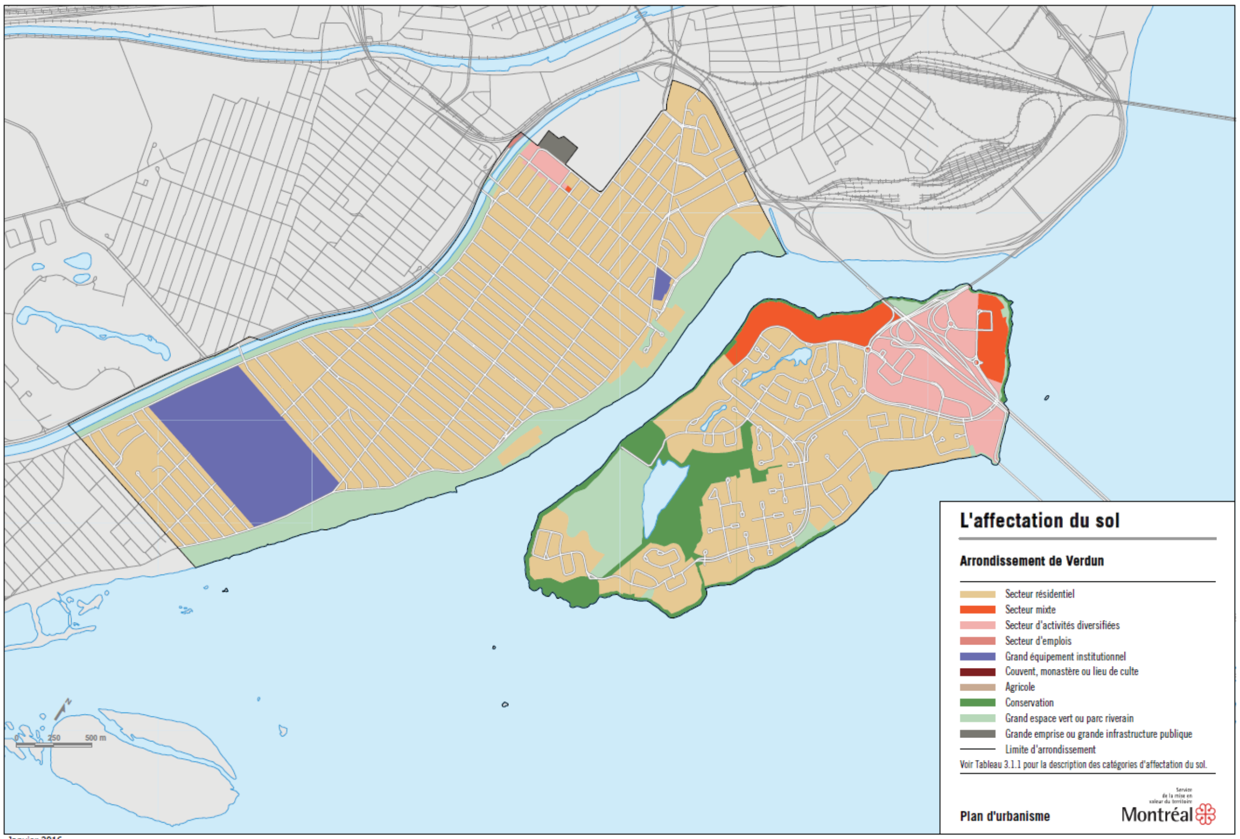
3.3.3.1 Sud-Ouest Borough

Land use in the Sud-Ouest Borough was studied as part of the 2013 EA. Since the projected areas for the deconstruction of the Existing Bridge will be restricted to the east side of Nuns' Island, land use for the Sud-Ouest Borough does not need to be updated.

3.3.3.2 Verdun Borough

The Nuns' Island district is part of the Verdun Borough, which includes five land-use categories: residential area, mixed area, diversified-activity area, conservation, and large green space or riverfront park (Ville de Montréal, 2005). There has not been a change in land-use category since 2013.

Most of Nuns' Island is a residential area. The diversified-activity, conservation and mixed areas have similar surface areas on the island. The first is an economic activity sector that may, under certain conditions, include housing near the mass transit system. The second represents an area for the protection and enhancement of biodiversity and of natural heritage and landscapes; it consists of a conservation strip all around Nuns' Island. Deconstruction of the Existing Bridge will thus free up the portion of the conservation strip that is currently encroached by the structure. Figure 35 presents land use in the Verdun Borough.



Source: Ville de Montréal, 2005.

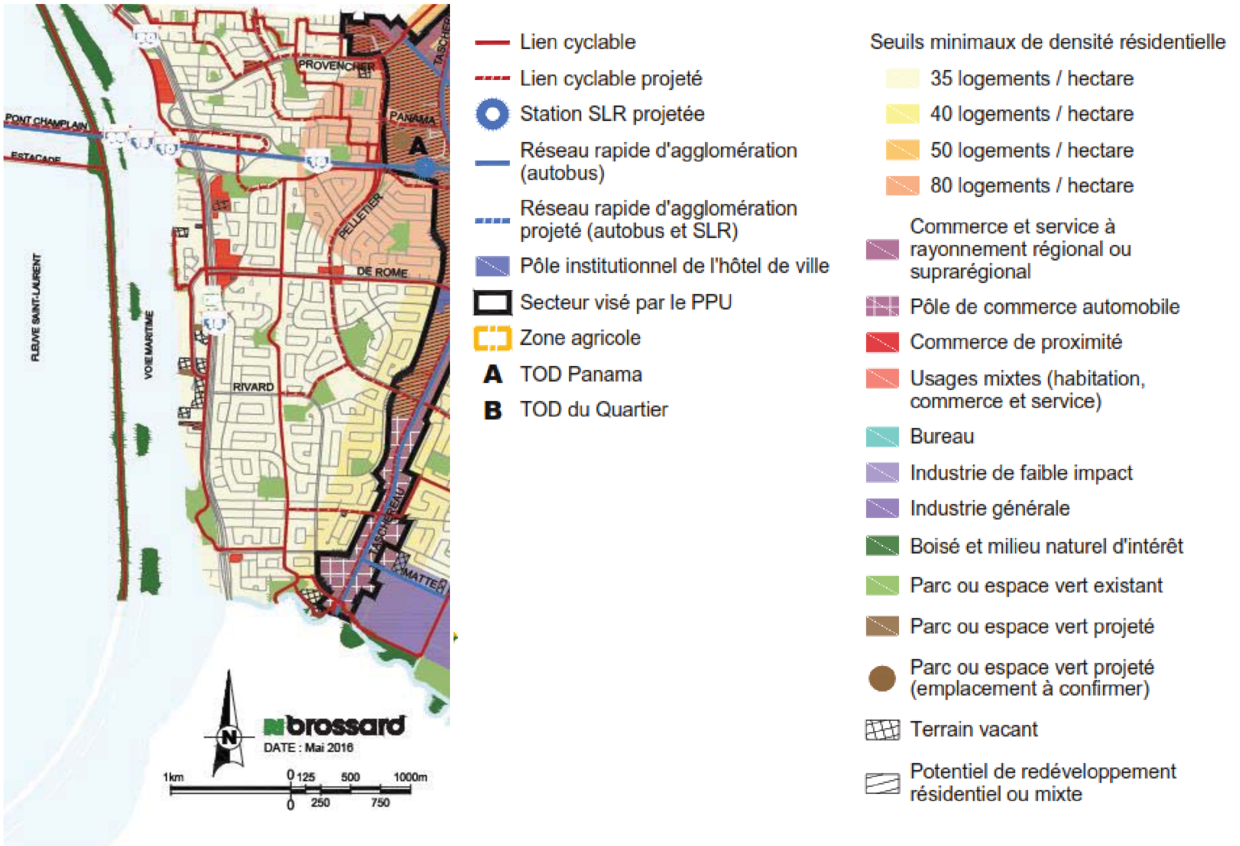
Figure 35 – Land use in the Verdun Borough, January 2016

3.3.3.3 City of Brossard

According to the Zoning Plan described in by-law REG-362 and part of the City of Brossard's Urban Plan (2016a), the project area includes the following land-use categories: public, housing, mixed, and commercial and services. The main land use is "housing."

The 2016-2035 summary of the urban plan (Ville de Brossard, 2016b) includes certain additional information on land use. According to the plan, the following categories are found in the project area: local stores, housing, automotive industry hub, mixed uses (housing, commercial and services); existing park or green space, forest and natural environment of interest, and proposed park or green space. These areas are illustrated in Figure 36.

The only use that may present a constraint for the deconstruction of the bridge is "forest and natural environment of interest," a part of which overlaps the bridge at the Seaway dike. A mobilization area for the construction of the New Bridge is currently found in this section; this same area will be used for the deconstruction of the Existing Bridge.



Source: Ville de Brossard, 2016b.

Figure 36 – Section of Brossard urban planning map, May 2016

The land-use and development plan for the agglomeration of Longueuil (2016), including the City of Brossard, identifies the main planning and development policies for the agglomeration.

The plan enabled the 2035 strategic vision statement to be drawn up along with several objectives and projects that contribute to realizing the visions of the future.

The plan has six main streams. Stream 1 is of interest to the project: *An agglomeration that bases its development on its assets*. Objective #5 of this stream is as follows: *Enhance recreational, ecological and cultural attractions from a recreational and tourism perspective*. One of the projects mentioned under this objective is the Greater Montreal Park Beach, described in section 3.3.3.6.

3.3.4 RECREATIONAL BOATING IN THE LA PRAIRIE BASIN (ST. LAWRENCE)

This section presents the information obtained to update the recreational boating activities described in the 2013 EA.

The company Saute-Moutons continues to offer jet boating excursions from May to late September. Starting in May 2019, Saute-Moutons will be adding another itinerary, known as “Panorama.” The Panorama itinerary will use the project area just like the regular “Jet Boating” itinerary.

The Panorama itinerary, shown on Map 11, begins at the Clock Tower Pier at the Old Port and passes under the Victoria Bridge to reach the New Champlain Bridge or the Ice Control Structure, where the boat turns back and heads to the Clock Tower Pier (personal communication with Jack Kowalski, owner of Saute-Moutons, on February 8, 2019).

Table 42 presents the features of the two Saute-Moutons itineraries.

The Blue Route (“Route bleue”) has itineraries for small human-powered craft (such as kayaks, canoes and paddle boards) that cross the project area. Information on the Blue Route presented in the 2013 EA is still valid (Myriam d’Auteuil, Regional Development Advisor, Sport et Loisir Montréal, March 1, 2019). The two itineraries in the project area (Map 11) are thus still used.

3.3.5 RECREATION AND TOURISM

This section presents the information obtained for updating the recreation/tourism activities described in the 2013 EA. However, note that some organizations that had shared information for the 2013 EA could not be reached. Other efforts will be made to obtain primary data on recreation and tourism activities during the information sessions on the deconstruction project.

3.3.5.1 Use of bike paths

Considered the largest cycling route in North America, the Green Route (“Route verte”) is a 5,300-km network that crosses all over Quebec, including the project area.

In 2016, JCCBI opened a bicycle path of more than 2 km long on the Ice Control Structure linking the Nuns’ Island network with the Seaway network 24 hours a day, from April to December.

The bike path that runs along the St. Lawrence on the South Shore, called “La Riveraine,” has been closed, with a detour being created in the cities of Brossard and Saint-Lambert in order to avoid the work site during the construction of the New Bridge. Vélo Québec would like the original route of this section of the Green Route to be restored once construction work on the New Bridge has been completed. However, it appears that the detour will remain to accommodate cyclists during the deconstruction of the Existing Bridge.

With respect to the Seaway dike, Vélo Québec maintains that the section of the Green Route between the Ice Control Structure and the Saint-Lambert locks is “essential and crucial” for cyclists and suggests that it remain open during the deconstruction of the Existing Bridge (personal communication with Louis Carpentier, Green Route development director, February 14, 2019). It appears that this section could remain open during the deconstruction, with some exceptions, which will be announced.

In the Nuns’ Island area, the Green Route itinerary when leaving the Ice Control Structure has been modified since its description appeared in the 2013 EA to avoid part of the approach to the New Bridge. The new route, which involves detours due to the construction of the New Bridge, is shown on Map 11.

The Nuns’ Island bicycle path, which links up with the Piste des Berges path on the Island of Montreal, was not altered.

The new Champlain Bridge will include a multi-use path intended for cyclists and pedestrians that will connect Nuns’ Island to Brossard and thus enhance and consolidate the existing bike path network (SSL, no date).

In October 2017, JCCBI created a rest area at the entrance to the Ice Control Structure bike path in Cours-du-Fleuve park for cyclists and pedestrians. Some of the work involved planting perennials, trees and shrubs (JCCBI, 2019).

3.3.5.2 Fishing

3.3.5.2.1 Fishing in the Seaway

The information on fishing in the Seaway presented in the 2013 EA does not need to be updated. Note that sport fishing is strictly prohibited in the Seaway and there is no commercial fishing.

3.3.5.2.2 Fishing in the St. Lawrence and the Lesser La Prairie Basin

Dessau-CIMA+ (2013) described sport fishing activities in the study area. There is fly-fishing and line fishing in the area using small boats. There is fishing in the section of the river near the Montreal and Nuns' Island shorelines, as well as in the Lesser La Prairie Basin. Boat fishing in the study area takes place between April and October, but more intensively in the summer.

The fish species available for recreational fishing in the project area are listed in Table 41.

Table 41 – Fish species of recreational interest to fishermen possibly caught in the project area

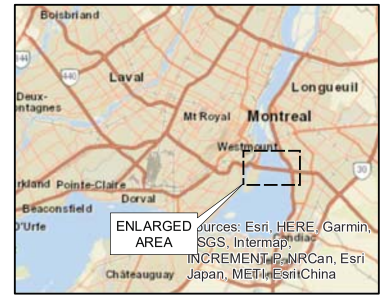
COMMON NAME	LATIN NAME
Smallmouth Bass	*Micropterus dolomieu*
Brown Bullhead	*Ameiurus nebulosus*
Carp	*Cyprinus carpio*
Rock Bass	*Ambloplites rupestris*
Northern Pike	*Esox lucius*
Walleye	*Sander sp.*
Sturgeon	*Acipenser sp.*
Yellow Perch	*Perca flavescens*
Channel Catfish	*Ictalurus punctatus*
Muskellunge	*Esox masquinongy*
Rainbow Trout	*Oncorhynchus mykiss*
Brown Trout	*Salmo trutta*

Source: Personal communication with Daniel Hatin, Biologist, MFFP, on February 26, 2019

According to the director of Maison des jeunes Point de mire, the quality of fishing has decreased significantly in the project area where, in early 2018, the organization's team was not able to catch any fish around the northern tip of Nuns' Island (Map 11). However, this has not been corroborated by the scientific data. The organization has since changed the itinerary of its fishing excursions, which now go to the Lachine rapids between Île aux Hérons and Rock Island, where species such as bass, pike, walleye and sometimes even trout can be caught (personal communication with Mario Viboux, Director of Maison des jeunes Point de mire, February 11, 2019).

PLAN VIEW

SCALE 1: 12,500



KEY PLAN

LEGEND:

- Route Verte bike path (Vélo Québec)
- Municipal bike path
- Bike path – closed section
- Bike path – blocked section
- Route Bleue itinerary – Lesser La Prairie Basin
- Route Bleue itinerary – Tour of Nuns' Island
- Proposed Scenic itinerary (Saute-Moutons)
- Abandoned fishing itinerary
- Parc Cours-du-Fleuve
- Kayak rental

Planned work areas

- Proposed jetty
- Mobilization area

DECONSTRUCTION OF EXISTING CHAMPLAIN BRIDGE (2017-2022)
Contract No. 62555
TARGETED ENVIRONMENTAL ANALYSIS

HUMAN ENVIRONMENT

Feb. 2019

Coordinate system: NAD 1983 UTM Zone 18n

Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, ©

Parsons Tetra Tech Amec Foster Wheeler

Map 11

Data sources:
- Kayak: KSF LaSalle, 2018
- Fishing: Pers. comm. with M. Viboux from Maison des jeunes Point de mire (February 2019)
- Bicycle: Vélo Québec, 2018; Vélo Québec, n. d.
- Parc Cours-du-Fleuve: JCCBI 2019
- Saute-Moutons itinerary: Pers. comm. with J. Kowalski from Saute-Moutons (February 2019)
- Work area: JCCBI (February 2019)

200 100 0 200 400 meter

1:12,500

C:\Users\ani.hebert\Documents_Projet2018\TX 18 0045 01.2002 Déconstruction du pont champlain\Carte 11 - Milieux humain\Carte 11 - Milieu-Humain - Eng..mxd

Table 41 – Characteristics of Saute-Moutons itineraries

ORGANIZATION	ITINERARY	BOAT CHARACTERISTICS		NAVIGATION CHANNEL			NAVIGATION PERIOD	FREQUENCY
		WIDTH (M)	DRAUGHT (M)	DEPARTURE POINT	CROSSOVER	RETURN		
Saute-Moutons Jet Boating	Jet Boating Tour	~4.3	1.5	Old Port of Montreal (Clock Tower Pier)	Champlain Bridge, Ice Control Structure (in the middle) Via the St. Lawrence	~0.5 km after Île aux Hérons	May	~ Twice a day (60 times)
							June	~ Four times a day (120 times)
							July-August	~ Five times a day (150 times)
							September	~ Once a day (40 times)
	Panorama Boating Tour	~4.3	1.5	Old Port of Montreal (Clock Tower Pier)	New Champlain Brid ge or Ice Control Structure (in the middle) Via the St. Lawrence	Just after the New Champlain Bridg e or Ice Control Structure Via the St. Lawrence	May	~ Once a day (30 times)
							June	~ Twice a day (60 times)
							July-August	~ Three times a day (180 times)
							September	~ Once a day (30 times)

Source: Personal communication with Jack Kowalski, owner of Saute-Moutons, February 8, 2019.

According to the representative of Maison des jeunes Point de mire, wading activities off the Island of Montreal along the wooded property of Monseigneur-Richard high school continue, since it appears that fishing is good in this area. However, there are 3 to 5 fishermen (and no longer 5 to 10) per day that practice wading fishing from May to November. Maison des jeunes still organizes wading activities once a week during the summer, mainly flyfishing and angling (personal communication with Mario Viboux, director of Maison des jeunes Point de mire, February 11, 2019).

3.3.5.3 Other recreational water activities

Just like Enviro Kayak and Navi Kayak described in the 2013 EA, KSF LaSalle is a kayaking company active in the project area. More specifically, it offers kayak, surfboard and paddle board rentals, excursions and courses at five locations in Montreal, including one on Nuns' Island, north of the Existing Champlain Bridge (KSF, 2018), as shown on Map 11. None of the three organizations could be contacted during the data gathering for this report as they are closed for the winter. The information sessions on the deconstruction of the Champlain Bridge didn't provide more details.

3.3.6 DEVELOPMENT PROJECTS

The main development projects in the general project area are described below.

3.3.6.1 New Champlain Bridge

The New Champlain Bridge is under construction just downstream of the Existing Bridge. This $4.2-billion project (which includes the cost of maintenance over 30 years) was started in 2015 and includes: construction of the 3.4-km-long New Champlain Bridge with three lanes in each direction, a multi-use pedestrian path and a corridor for mass transit; a new bridge for Nuns' Island; the widening of Highway 15 between the Atwater Interchange and the New Bridge; and upgrades to the Highway 132 and Highway 10 bridge onramps on the South Shore. The New Champlain Bridge was opened to traffic in late June/early July 2019, while the widening of Highway 15 should be completed by the end of 2020 (IC, 2018). The deconstruction of the Existing Champlain Bridge is one of the last stages of this major project.

3.3.6.2 Réseau express métropolitain

The Réseau express métropolitain (REM) is a new light rail rapid transit system. The 67-km-long system will have 26 stations and extend across the Greater Montreal Area. Construction has started on the REM rapid transit system, deemed the largest mass transit project in Quebec in the last 50 years. It has a budget of $6.3 billion (CDPQ Infra, 2019).

The first departures are scheduled for 2021 on the line running from the South Shore to Central Station. The rest of the system will be progressively deployed in 2022-2023 (REM, 2018). The Île-des-Sœurs and Panama stations are part of the South Shore/Central Station REM line. The Île-des-Sœurs station will be built to the southeast of the traffic circle that links Boulevard René-Lévesque and Rue Jacques-le Ber, between Highways 10 and 15 (CDPQ Infra, 2019). The Panama station will be built at the Panama bus terminal, near Highway 10 and Boulevard Taschereau (City of Brossard, no date). Construction on the two stations will begin in late 2019, and the stations will be operational in late 2021.

3.3.6.3 Nuns' Island Bridge

The new Nuns' Island bridge linking Nuns' Island to the Verdun Borough was inaugurated in December 2018 (La Presse, 2018). The roughly 500-m-long bridge has four lanes in each direction, including three for road traffic and one multi-use path. It has a projected useful lifespan of 125 years (IC, 2018).

3.3.6.4 Reconstruction of Turcot Interchange

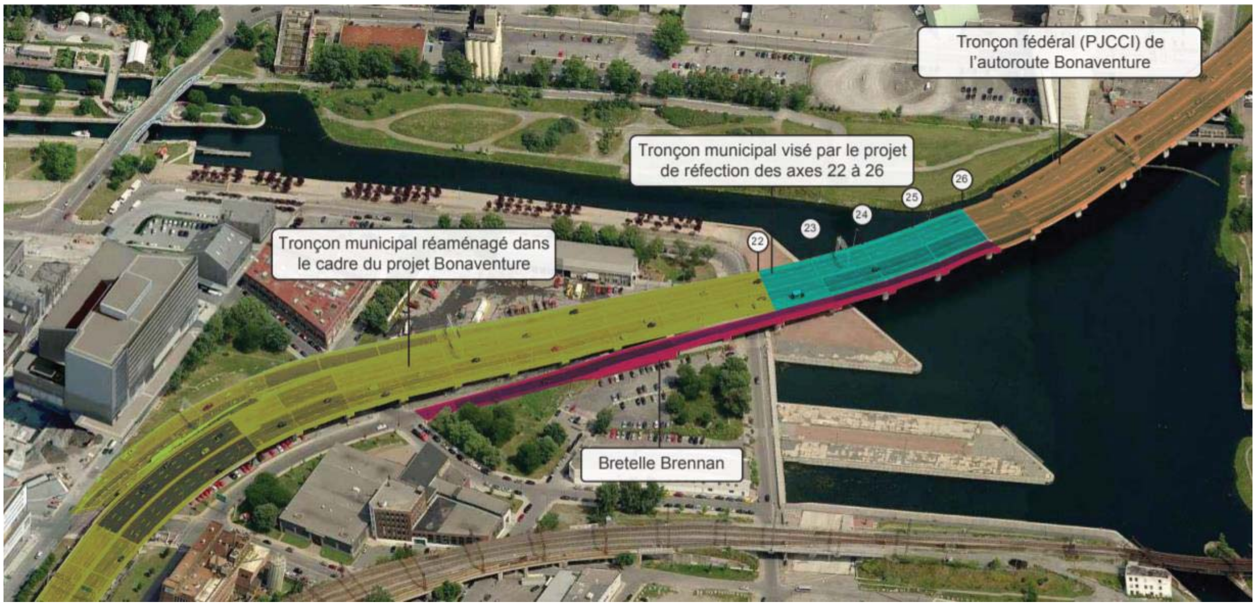
The $3.67-billion Turcot Interchange reconstruction project was 70% complete in early 2019 and should be finished in 2020. This project affects Highways 20 and 15, which cross the Existing Bridge. The Turcot Interchange is used by 300,000 drivers per day (MTQ, 2019).

3.3.6.5 Upgrading of Bonaventure Expressway

Upgrading of the Bonaventure Expressway includes structural repairs along with the demolition of the Brennan onramp, which has been closed to traffic since December 2016 (Figure 37). Work was started in spring 2018 and should be completed in 2019. It consists of the following:

- Phases 1 and 2 in 2018: repairs to the Montreal-bound expressway and specific work;
- Phases 3 and 4 in 2019: repairs to the South Shore-bound expressway and demolition of the Brennan onramp.

The above work is part of ongoing work carried out and completed by JCCBI on the federal section of the expressway (City of Montréal, 2019a; city of Montréal, 2019b).



Source: Ville de Montréal in Robichaud, 2018.

Figure 37 – Upgrading of Bonaventure Expressway

3.3.6.6 Greater Montreal Park Beach

The Greater Montreal Park Beach is one of five metropolitan projects that make up the Green and Blue Grid (CMM, 2016). The project consists in creating a linear park and beaches along the Seaway dike (on the St. Lawrence side) linking the Récré-O-Parc at the western tip and Parc Jean-Drapeau at the eastern tip, for a total of about 20 km.

Centered on outdoor recreation, the Park Beach will be connected to the Oka–Mont Saint-Hilaire Trail and accessible by bike via the Green Route, or by foot using the shuttle from the Île Sainte-Hélène metro station. Activities include fishing, kayaking, canoeing, windsurfing, paddle boarding and birdwatching (La Presse, 2017).

3.3.6.7 Verdun urban beach

The Verdun urban beach is located along the St. Lawrence, more specifically behind the Verdun Auditorium in Arthur-Therrien Park. The site was chosen based on 18 criteria, including water quality, wildlife habitats, fish habitats, vegetation, coastal and shore features, and the proximity of existing services (City of Montréal, 2016).

The Verdun urban beach is part of the legacy of Montreal's 375th Anniversary and the City of Montréal's water plan, one objective of which is to improve shoreline water quality to enable swimming (Le Devoir, 2018). It is part of the creation of a large-scale sports, recreational and cultural hub along the shoreline (City of Montréal, no date). The beach is slated to be opened in 2019 (Verdun Borough, 2018).

3.3.7 SOUND ENVIRONMENT

The 2013 EA detailed the impacts of the construction and operation of the New Champlain Bridge, especially fluctuations in traffic for the road infrastructure caused by the replacement of the Existing Champlain Bridge (i.e. an increase in traffic for the target year, route changes). The current assessment evaluates the temporary noise and vibration impacts created during the deconstruction of the Existing Bridge, after the entering into service of the New Champlain Bridge. Deconstruction activities will temporarily increase the noise levels in adjacent Noise Sensitive Areas (NSAs), composed of either residential or mixed residential and commercial areas. In addition to noise activities, equipment on site with high potential to generate vibrations have been assessed in relation to the potential to cause damages to nearby structures.

The following documents were analyzed to obtain information on noise levels in NSAs:

- 2013 EA;
- Reports on the management of construction noise from November 2016 to April 2018 (referred to in this document as construction noise reports) (SSL, 2018a, b, c) prepared as part of the implementation of the noise management plan for construction work (SSL, 2015).

Based on this analysis, the noise data in the noise management reports related to the construction of the New Champlain Bridge are considered as being the most recent.

Three areas in both Nuns' Island and Brossard where noise was being monitored before and during construction of the New Champlain Bridge were also considered as sensitive to noise for the deconstruction of the Existing Champlain Bridge and are used to consider the sound environment related to deconstruction work and the transport of materials. These areas are shown in Figure 38 and Figure 39. Note that schools and hospitals are located further from the works than the sensitive areas that were identified, and therefore, if noise levels are observed in sensitize areas, they will also be observed around schools and hospitals (the criteria are the same pour residential neighbourhoods, schools and hospitals).

Figure 38 – Noise sensitive areas on Nuns' Island

Figure 39 – Noise sensitive areas in Brossard

The data obtained from various sources and dating from May 2015 are summarized in Table 43. On Nuns' Island, noise levels ranged from 57 to 64 dB(A) during the day and decreased slightly in the evening and at night, while remaining fairly high (52 to 59 dB(A). Noise levels are about the same on the Brossard side, namely 58 to 62 dB(A) during the day, while slightly dropping at night.

Table 43 – Summary of noise levels measured during construction of the New Champlain Bridge

LOCATION		BACKGROUND NOISE		
		LAEQ IN A DECIBELS		
AREA	ID NUMBER	DAY 7 A.M. TO 7 P.M.	EVENING 7 P.M. TO 11 P.M.	NIGHT 11 P.M. TO 7 A.M.
Nuns' Island	Area I1	57	53	54
	Area I2	64	59	57
	Area I3	57	52	52
Brossard	Area B1	60	57	57
	Area B2	62	62	58
	Area B3	58	57	55

Note: LAeq is the A-weighted equivalent continuous sound level for a specified period of time. It is a single value (a type of average) that describes the total sound energy at a precise point of reception over a specific period of time and that takes into account all of the sound level fluctuations thus making it an "average." The "A" in LAeq refers to an A-weighting, which can be described as a frequency filter that is shaped to correlate measured sound pressure levels with human assessment and perception of loudness.

3.3.8 ARCHEOLOGY

As presented in Dessau-Cima+ (2013), a few areas with archeological potential were defined and four archeological sites were identified in or near the construction footprint of the New Bridge (see maps in Appendix 12). None of these areas are found in the Existing Champlain Bridge deconstruction footprint, or the areas have already been impacted by the construction of the New Bridge. Archeology is therefore not an issue for this project.

Since the Quebec *Cultural Heritage Act* requires anyone who discovers an archeological property or site to report it immediately to the Minister of Culture, a mitigation measure will stop work in the event of any incidental finds of archeological items, for the time it takes to make an archeological declaration and dig, if required.

3.4 SUMMARY OF KEY ISSUES

Although impacts and mitigation measures are covered in the second part of the TEA report, this section provides an overview of the key points related to the current environmental components and the aspects to consider in the next stages of the project.

3.4.1 SOIL QUALITY

Environmental characterizations have revealed the presence of contaminated soil and groundwater at the future deconstruction work site. Soils contaminated by PAHs, metals and/or petroleum hydrocarbons C_{10}-C_{50} were identified, while asbestos was also found in a few boreholes. Manganese and chloride contamination was found in groundwater.

Deconstruction work does not include environmental rehabilitation of the site. However, the work may include contaminated soil and groundwater management in accordance with current regulations.

The elements to be taken into account by the contractor during deconstruction work include:

- Identifying excavation or backfilling areas for the entire work site;
- Specifying the environmental quality of soil and groundwater in excavation or backfilling areas based on existing environmental data, and identifying any areas to be characterized;
- Adequate environmental management of soil and groundwater, including a traceability system for the soil and groundwater taken off site.

3.4.2 CONTAMINANTS ON BRIDGE MATERIALS

A preliminary partial inspection of the bridge was done in December 2018 to determine whether there were any materials likely to contain asbestos, silica or lead, as well as to determine the presence of bird droppings. Visual sighting and sampling were done to confirm the presence of these contaminants. OHS risk management measures were drawn up.

It is important to mention that some potentially problematic materials such as asphalt mixes and the type of material found in lighting systems were not assessed and must undergo additional characterization given their potentially significant impact on demolition costs.

3.4.3 ICE

Since 2005, the ice season has lasted from 50 to about 120 days. The ice season is longer in the Seaway than the St. Lawrence mainly because of the static cover formed there, which remains in place until it melts. In general, the ice flow is significantly affected by climate change. The extent of the static ice cover on the St. Lawrence thus appears to progressively decrease with a more marked trend since winter 2012. Similarly, the first observations of pack ice tend to occur later, especially since winter 2012. The thickness of the ice also seems to be decreasing in the last few years.

Ice is an issue to consider for the stability of the temporary structures (jetties) as well as for the pier or footing sections that may be left in place following deconstruction. In fact, ice conditions should be part of the jetty design to ensure that the jetties are strong and safe enough for the two or three years they will be left in place. Modelling will have to be done in this respect by the contractor in charge of building the jetties. Similarly, if any piers or sections of piers or footings of the Existing Champlain Bridge have to be left in place, ice conditions should also be studied and modelled. This will be done at a later stage.

3.4.4 SURFACE WATER QUALITY

The main issue involved in surface water quality is related to variations in turbidity/suspended particulate matter (SPM). A monitoring program will be implemented before work is done that is likely to generate suspended particulate matter (SPM). The program will include control stations upstream and stations downstream, in the turbidity plume. The alert thresholds of 25 and 5 mg/l at respectively 100 and 300 m from the source will be used to monitor the effect and, if required, modify the work methods or temporarily stop work.

3.4.5 SEDIMENT QUALITY

Since deconstruction work may affect areas with contaminated sediment, the main issue is that sediment that has been contaminated to some extent could be resuspended.

The sediments sampled in 2018 in the Greater La Prairie Basin showed metal and PCB concentrations below the OEL criterion. However, the levels of four PAH compounds were above the applicable OEL criterion. These results are added to the historical data that show criteria exceedances for these groups of parameters in the Lesser La Prairie Basin. Sediment management measures must therefore be implemented.

3.4.6 AIR QUALITY

Existing anthropogenic sources in the project area generate emissions that will be added to the emissions which the deconstruction of the Existing Champlain Bridge should generate.

Prior to the construction of the New Champlain Bridge, the reference concentrations at representative NAPS stations near the project area were generally considered as good compared to ambient air criteria. A few exceedances of the parameters monitored during the construction of the New Bridge were noted, but efficient mitigation measures were implemented to reduce them significantly.

The main elements to monitor for the deconstruction project will be particulate matter ($PM_{2.5}$, PM_{10} and PM_{tot}), silica and lead. Based on an assessment of meteorological data and the location of the deconstruction sources, five main receptors in residential areas are likely to be affected by the emissions generated by deconstruction work: one on Nuns' Island and four in Brossard (see section 6.3.4 of volume 2 for more details and the location of the receptors).

3.4.7 FLORA

The issues regarding flora components mainly concern special-status species as well as IAS.

There are few natural environments in the study area and several of them have already been impacted during the construction of the New Champlain Bridge, in particular in mobilization areas. There is no natural environment that is a rare ecosystem at a regional level.

No species identified by the *Species at Risk Act* (S.C. 2002, c. 29) or the *Act Respecting Threatened or Vulnerable Species* (R.S.Q., c. E-12.01) was found in the study area. Only two species likely to be designated as threatened or vulnerable are found in the study area: the Laurentian water-horehound (Lycopus americanus var. laurentianus) and the rough water-horehound (Lycopus asper).

At the work planning stage, mitigation measures will be put in place for the Laurentian water-horehound and rough water-horehound and will first consist in trying to avoid them and protect them, or if not, consider transferring specimens outside of the work area.

Moreover, several IAS are found in the study area. If they were to be dug up during the work, special measures will be implemented to prevent them from spreading.

In addition, natural environments disrupted by work done on the bank and shoreline will be renaturalized. Native plant species will be used for the renaturalization, and seeding and planting will be done quickly to prevent colonization by invasive species.

3.4.8 WILDLIFE

3.4.8.1 Fish fauna

The fish population in the study area is highly diversified, with 98 species potentially occurring in the area. The fish population is dominated by warmwater species. Most of the species that are known or suspected to be in the area spawn in the spring or early summer. Therefore, this period is considered as being sensitive for the fish in the study area and the protection of spawning grounds is an issue related to the project. A restriction period for in-water works to protect the main species of interest and status species in the study area must be established and observed.

The habitats considered sensitive in the study area in 2018 are types 1, 2, 3, 4, 6, 8, 12, 13, 13a, 14, 16, 18, 21 and 22. Some sensitive habitats were found in the immediate vicinity of the Existing Champlain Bridge in 2012 (types 2, 4, 12, 16 and 22). The issue regarding habitats consists in minimizing the encroachment of the temporary structures (jetties). There will be a compensation project for encroachments that cannot be avoided. Special attention must also be paid to the breeding habitats identified in the area by the CDPNQ and also to SSL's fast water compensation project located directly upstream from the Champlain Bridge to be deconstructed.

The area is used by several species during migration. These constitute another project issue. Fishways will be required in the jetties and certain velocity and water-level criteria will have to be observed to facilitate migration.

Of the 98 species of fish potentially occurring in the study area, 21 have a provincial or federal conservation status. Seven of these have been recently documented in the study area. Although no known spawning habitat for these species has been found in the study area, the restriction period for in-water works must be revised based on the status species occurring in the area.

Two species of fish (Round Goby and Rainbow Trout), whose presence was confirmed in the study area, are considered to be invasive alien species. Asian Carp is also potentially present in the study area. Measures must be implemented to limit the spread of these species during the deconstruction of the Champlain Bridge.

Limited in-water works along with measures aimed at minimizing the emission of SPM and observance of the critical periods for spring spawning are considered to mitigate work-related impacts. Compensatory measures will be proposed for temporary encroachments related to the jetties.

3.4.8.2 Macroinvertebrates

The exhaustive inventory carried out as part of the TEA did not detect the presence of living Hickorynut individuals. Given the habitat characteristics sought by the species and the inventory that was carried out, the risk of observing Hickorynut in the original Champlain Bridge sector is therefore low. However, if new information on the species (for example, concerning the characteristics of habitats used by the species) becomes available, it will be taken into consideration during the authorization phase at DFO to determine whether additional measures are required to reduce the risk of impacting the species.

3.4.8.3 Herpetofauna

There are few suitable habitats in the study area for turtles and amphibians. However, the rocky shores of the St. Lawrence and the Seaway dike provide a habitat for snakes, including the Brown Snake. This species is likely to be designated threatened or vulnerable in Quebec under the *Act Respecting Threatened or Vulnerable Species* (R.S.Q., c. E-12.01). However, according to COSEWIC's assessment, it is not considered at risk in Canada.

The presence of the Brown Snake is the only noteworthy element with respect to herpetofauna. This species, which has a limited home range, was sighted at the stations on Nuns' Island and on the Seaway dike. Habitats suitable to this species of snake are abundant (scrubland and forest borders). Although no natural hibernacle was confirmed with certainty in the surveyed area, rock piles present a potential in this respect and the artificial hibernacle created in Parc Cours-du-Fleuve on Nuns' Island meets the species' needs, according to the monitoring conducted by the MFFP. Special measures will have to be implemented to limit impacts on this species.

3.4.8.4 Birds

The Existing Champlain Bridge serves as a nesting site for hundreds of birds, including a large colony of Cliff Swallows and a special-status species, the Peregrine Falcon. The latter species is designated vulnerable in Quebec and classified as a species of special concern in Canada (Schedule 1 of the *Species at Risk Act*), although it appears that it is no longer at risk. In 2018, a decrease in the number of Cliff Swallow nests was noted on sections 5 and 7 of the Champlain Bridge, whereas the Cliff Swallow population nesting on the Ice Control Structure has been growing since 2013.

Part of the Seaway dike as well as islands and rocky islets provide nesting habitats for several species of land and aquatic birds. One such habitat is the Couvée Islands Migratory Bird Sanctuary, a protected wildlife habitat under the Migratory Birds Convention Act, 1994. The St. Lawrence is a major migratory corridor for birds, including aquatic birds. During their migration, aquatic birds and waterfowl use protected areas, namely the two WGAs in the La Prairie basin and the IBA located upstream of Nuns' Island.

The deconstruction of the bridge may have an effect on the birds found in the nearby aquatic and riparian habitats. The Peregrine Falcon is an important species to consider in relation to the present project, since each of its nesting sites is not only still a source of concern for conservation but also for the safety of workers who have to work near the nests. The presence of a major Cliff Swallow colony nesting on the Existing Champlain Bridge is also a major issue.

Mitigation measures were implemented as part of the construction of the New Champlain Bridge in order to install nesting boxes on the New Bridge to help the Peregrine Falcon move from one structure to the other. There will be proper coordination between JCCBI and SSL to ensure that this measure is successful. Given the importance of the Cliff Swallow's habitat on the Champlain Bridge, a systematic management plan for this species is required.

Lastly, if work is to be done at the Couvée Islands Migratory Bird Sanctuary, a permit first has to be issued by federal environmental authorities under the Migratory Birds Convention Act, 1994 and the Migratory Bird Sanctuary Regulations (C.R.C., c. 1036). No work is planned at that location for the time being.

3.4.9 NAVIGATION

Authorization under the Canadian Navigable Waters Act (CNWA) must be obtained from Transport Canada for the project. A notice of works will be sent to the Navigation Protection Program.

3.4.9.1 St. Lawrence Seaway

The elements to consider for the Seaway basically consist in obtaining the authorization of the St. Lawrence Seaway Management Corporation (SLSMC) to carry out work over the Seaway during the navigation season.

3.4.9.2 St. Lawrence River and Greater La Prairie Basin

Navigation in the St. Lawrence and the La Prairie Basin at the New Bridge is limited to users who are very familiar with the area (CCG and Saute-Moutons) for larger boats, but it is also accessible to amateurs who wish to use light watercraft, as evidenced by two circuits of the Greater Montreal Blue Route that cross through the study area.

The elements to consider are limited knowledge of hydraulic conditions around the bridge, conditions which the presence of the temporary jetties and future removal of the existing piers may modify. Over the short term, at the start of deconstruction work, the new pier arrangement (Existing Bridge and New Bridge) could also have an impact on channel position and depth as well as ice flow, in addition to adverse effects on navigation. These elements must be carefully considered during the next stages of the project.

Recreational and pleasure boating could be maintained while the work is being done, but will require that an information campaign be conducted among organizations and users jointly with the authorities involved, the application of strict navigation measures and the cooperation of monitoring and response organizations to ensure the safety of boaters and workers, to ensure that the conditions stipulated in the authorization issued under the CNWA are observed.

3.4.10 RECREATION AND TOURISM

3.4.10.1 Commercial and sport fishing

Commercial and sport fishing is prohibited in the St. Lawrence Seaway.

There is no commercial fishing in the St. Lawrence and the Lesser La Prairie Basin 1 km upstream and downstream of the Existing Champlain Bridge. However, the area is used by sport fishermen from April to October who practice line fishing or use small watercraft to cross the project area. The main fishing points are not known and little information is available on traffic and the number of fishermen who use the area. From January to March near the Champlain Bridge park, ice fishing is practiced less than 300 m upstream and downstream of the Existing Champlain Bridge.

Just like recreational and pleasure boating, sport fishing could also be maintained while the work is being done, but it will require that an information campaign be conducted among fishermen in conjunction with the authorities involved, the application of strict navigation measures, and the cooperation of monitoring and response organizations to ensure the safety of fishermen and workers.

3.4.10.2 Bike path

The project may cause the closure of certain bike paths for more or less extended periods of time, and may require that some of them be temporarily relocated. Special attention must be given to keeping bike paths operational during the work.

3.4.11 SOUND ENVIRONMENT

Several noise-sensitive areas have been identified around the project, corresponding to residential areas, or residential/commercial areas. The noise caused by the deconstruction of the Existing Champlain Bridge will temporarily increase noise levels in these areas. The contractor must be required to draw up a noise management plan, with mitigation measures in the event noise level criteria are exceeded. Regular monitored at the work site will also be required to quickly respond to exceeded limits.

The noise level of any construction work must not exceed the limits determined by the Ministère du Transport du Québec (MTQ) stipulated in “Ouvrages routiers, tome II, chapitre 9” (MTMDET, 2018). More specifically, section 9.9 presents several specifications on sound environment monitoring during construction, which are summarized in Table 44.

Table 44 – Specifications on sound environment monitoring during construction

SECTION OF MTQ STANDARDS	ELEMENT DESCRIBED	MAIN RECOMMENDATIONS
9.9.1.2	Sound environment modeling	One of the models used to assess the noise generated by a construction site, i.e. Roadway Construction Noise Model (RCNM), designed for the U.S. Federal Highway Administration (FHWA).
9.9.1.3	Noise level measurement	Standards to be used to measure sound levels, namely, SAE Standard J1075, Sound Measurement – Construction Site for the measurement of construction site noise. The measurement of noise levels generated by a particular piece of equipment at a construction site must be done in accordance with the measurement method described in Measurement of Highway-Related Noise, May 1996, from the FHWA (FHWA PD-96-046).
9.9.1.3	Noise level measurement	Lists the four different operating modes of equipment at work sites for which noise measurements are made.
9.9.1.4	Maximum recommended noise levels	Table 9.9-1 lists the maximum noise levels generated by a work site not to be exceeded for nearby sensitive residential areas.
9.9.1.4	Maximum recommended noise levels	Table 9.9-2 lists the maximum recommended noise levels for equipment at work sites.
9.9.1.4	Measurement period	Defines the periods during the day (7 a.m. to 7 p.m.), evening (7 p.m. to 11 p.m.) and night (11 p.m. to 7 a.m.) corresponding to the criteria in table 9.9-1 for which the ambient noise level must be defined.
9.9.1.4	Duration of noise measurements	Defines the duration of measurements in relation to table 9.9-1, i.e. an integration of the measurements made for a 30-minute period.
9.9.1.4	Noise measurement equipment	Lists the equipment that must be used for noise measurements, i.e. a Class 1 integrating Sound Level Meter, in accordance with ANSI S1.4 – 1983 (R 1990) "Specification for Sound Level Meters."
9.9.1.4	Application of criteria based on sensitive uses	Specifies the location where the recommended maximum sound levels apply, i.e. 5 m from the building being protected (e.g. home, school, hospital) or at the property line if the building is located less than 5 m from the road where the work is being done. The limits to be observed apply to the ground floor as well as to the floors of the buildings being protected. The nighttime limit does not apply near a school.
9.9.1.4	Noise Limits	Clarifies that the noise limits identified in Table 9.9-1, in the case of schools are not applicable for Nighttime.
9.9.2	Noise management program	Lists the contents of the noise management program, including details on the acoustic monitoring plan and the detailed noise control program.
9.9.3.1 9.9.3.2 9.9.3.3	Sound mitigation measures	Lists the mitigation measures that can be applied, i.e. at-source measures, those applied for noise propagation, and mitigation measures applied to receptors.
9.9.3.4	Characteristics and required performance for temporary noise barriers	Defines the required performances for noise barriers and their characteristics.

The limits to be considered based on the type of sensitive area and the different times of day, according to table 9.9.1 in the MTQ standard, are presented in Table 45. Note that Brossard and Verdun also have criteria regarding nuisances. However, since the MTQ limits are more complete and standardized and were used for the construction of the New Bridge, they will be used for the project.

Table 45 – Recommended maximum sound levels along the areas being protected (MTQ)

AREA AND LAND USE	SOUND LEVELS NOT TO BE EXCEEDED (DBA) (AMBIENT AND WORK SITE NOISE COMBINED)			
	UNIT	DAY (7 A.M. TO 7 P.M.)	EVENING (7 P.M. TO 11 P.M.)	NIGHT (11 P.M. TO 7 A.M.)
Noise sensitive/residential: homes, hospitals and schools, parks and hotels, etc.	L_{10}	75 or ambient noise + 5 (A)	Ambient noise + 5	Ambient noise + 5 (if ambient noise < 70) Ambient noise + 3 (if ambient noise ≥ 70)
	L_{max}	85 or 90 for impact noise (B)	85	80
Commercial areas: office buildings, stores, etc.	L_{10}	80 or ambient noise + 5 (A)	Ambient noise + 5 (C)	None
	L_{max}	None	None	None
Industrial areas: plants, shops, etc.	L_{10}	85 or ambient noise + 5 (A)	None	None
	L_{max}	None	None	None

A. Higher of the two limits.
B. Impact noise is intermittent noise with a rapid onset.
C. If applicable, during store opening hours.

Deconstruction work should be planned in keeping with specific scheduled activities and their potential impact on nearby sensitive areas. The selected contractor shall conduct modeling for specific sites and activities once its work methods and equipment have been clearly determined. Before the start of deconstruction and after the New Bridge has been commissioned, the contractor shall measure background noise levels in order to update baseline data. The contractor shall also update mitigation measures based on the modeling results. Hence, if the maximum noise levels cannot be observed, measures such as adding a sound barrier, modifying the pace of work or number or type of equipment being simultaneously operated, or modifying the number trucks per hour transporting materials, shall have to be implemented by the contractor.

3.4.12 ARCHEOLOGY

There are no archeological sites or areas with archeological potential in the deconstruction work area. In some cases, areas were present but have already been affected by the work related to the New Bridge. There is a possibility of incidental finds during the work period. In such a case, a mitigation measure involves stopping work in the event of any incidental finds of archeological elements, for the time it takes to make an archeological declaration and a dig, if required.

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